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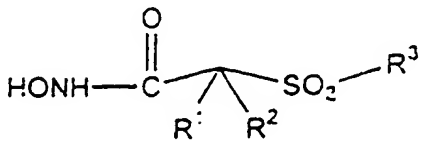

(I)

(57) Abstract

A treatment process is disclosed that comprises administering an effective amount of an aromatic sulfone hydroxamic acid that exhibits excellent inhibitory activity of one or more matrix metalloprotease (MMP) enzymes, such as MMP-2, MMP-9 and MMP-13, while exhibiting substantially less inhibition at least of MMP-1 to a host having a condition associated with pathological matrix metalloprotease activity. The administered enzyme inhibitor corresponds in structure to formula (I), below, or a pharmaceutically acceptable salt thereof, wherein R^1 and R^2 are both hydrido or R^1 and R^2 together with atoms to which they are bonded form a 5- to 8-membered ring containing one, two or three heteroatoms in the ring that are oxygen, sulfur or nitrogen. R^3 in formula (I) is an optionaly substituted aryl or optionally substituted heteroaryl radical. Also disclosed are metalloprotease inhibitor compounds having those selective activities, processes for manufacture of such compounds and pharmaceutical compositions using an inhibitor.

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AROMATIC SULFONE HYDROXAMIC ACID METALLOPROTEASE INHIBITOR

Description

Technical Field

This invention is directed to proteinase (protease) inhibitors, and more particularly to the use of aromatic sulfone hydroxamic acid compounds that, *inter alia*, are selective inhibitors of matrix metalloproteinases in a process for treating conditions associated with pathological matrix metalloproteinase activity, the selective inhibitors themselves, compositions of proteinase inhibitors, intermediates for the syntheses of proteinase inhibitors, and processes for the preparation of proteinase inhibitors.

Background of the Invention

Connective tissue, extracellular matrix constituents and basement membranes are required components of all mammals. These components are the biological materials that provide rigidity, differentiation, attachments and, in some cases, elasticity to biological systems including human beings and other mammals. Connective tissues components include, for example, collagen, elastin, proteoglycans, fibronectin and laminin. These biochemicals makeup, or are components of structures, such as skin, bone, teeth, tendon, cartilage, basement membrane, blood vessels, cornea and vitreous humor.

Under normal conditions, connective tissue turnover and/or repair processes are controlled and in equilibrium. The loss of this balance for whatever reason leads to a number of disease states. Inhibition of the enzymes responsible loss of equilibrium provides a control mechanism for this tissue decomposition and, therefore, a treatment for these diseases.

Degradation of connective tissue or connective tissue components is carried out by the action of proteinase enzymes released from resident tissue cells and/or invading inflammatory or tumor cells. A major class of enzymes involved in this function are the zinc metalloproteinases (metalloproteases).

The metalloprotease enzymes are divided into classes with some members having several different names in common use. Examples are: collagenase I (MMP-1, fibroblast collagenase; EC 3.4.24.3); collagenase II (MMP-8, neutrophil collagenase; EC 3.4.24.34), collagenase III (MMP-13), stromelysin 1 (MMP-3; EC 3.4.24.17), stromelysin 2 (MMP-10; EC 3.4.24.22), proteoglycanase, matrilysin (MMP-7), gelatinase A (MMP-2, 72 kDa gelatinase, basement membrane collagenase; EC 3.4.24.24), gelatinase B (MMP-9, 92 kDa gelatinase; EC 3.4.24.35), stromelysin 3 (MMP-11), metalloelastase (MMP-12, HME, human macrophage elastase) and membrane MMP (MMP-14). MMP is an abbreviation or acronym representing the term Matrix Metalloprotease with the attached numerals providing differentiation between specific members of the MMP group.

The uncontrolled breakdown of connective tissue by metalloproteases is a feature of many pathological conditions. Examples include rheumatoid arthritis, osteoarthritis, septic arthritis; corneal, epidermal or gastric ulceration; tumor metastasis, invasion or angiogenesis; periodontal disease; proteinuria; Alzheimers Disease; coronary thrombosis and bone disease. Defective injury repair processes also occur. This can produce improper wound healing leading to weak repairs, adhesions and scarring. These latter defects can lead to disfigurement and/or permanent disabilities as with post-surgical adhesions.

Metalloproteases are also involved in the biosynthesis of tumor necrosis factor (TNF), and inhibition of the production or action of TNF and related compounds is an important clinical disease treatment mechanism. TNF-α, for example, is a cytokine that at present is thought to be produced initially as a 28 kD cell-associated molecule. It is released as an active, 17 kD form that can mediate a large number of deleterious effects *in vitro* and *in vivo*. For example, TNF can cause and/or contribute to the effects of inflammation, rheumatoid arthritis, autoimmune disease, multiple sclerosis, graft rejection, fibrotic disease, cancer, infectious diseases, malaria, mycobacterial infection, meningitis, fever, psoriasis, cardiovascular/ pulmonary effects such as post-ischemic reperfusion injury, congestive heart failure, hemorrhage, coagulation, hyperoxic alveolar injury, radiation damage and acute phase responses like those seen with infections and sepsis and during shock such as septic

shock and hemodynamic shock. Chronic release of active TNF can cause cachexia and anorexia. TNF can be lethal, and TNF can help control the growth of tumor cells.

TNF-α convertase is a metalloprotease involved in the formation of soluble TNF-α. Inhibition of TNF-α convertase (TACE) inhibits production of active TNF-α. Compounds that inhibit both MMPs activity and TNF-α production have been disclosed in WIPO International Publication Nos. WO 94/24140, WO 94/02466 and WO 97/20824. Compounds that inhibit MMPs such as collagenase, stromelysin and gelatinase have been shown to inhibit the release of TNF (Gearing et al. *Nature* 376, 555-557 (1994), McGeehan et al., *Nature* 376, 558-561 (1994)). There remains a need for effective MMP inhibitors. There also remains a need for effective TNF-α convertase inhibiting agents.

MMPs are involved in other biochemical processes in mammals as well. Included is the control of ovulation, post-partum uterine involution, possibly implantation, cleavage of APP (β-Amyloid Precursor Protein) to the amyloid plaque and inactivation of α_1-protease inhibitor (α_1-PI). Inhibition of these metalloproteases permits the control of fertility and the treatment or prevention of Alzheimers Disease. In addition, increasing and maintaining the levels of an endogenous or administered serine protease inhibitor drug or biochemical such as α_1-PI supports the treatment and prevention of diseases such as emphysema, pulmonary

diseases, inflammatory diseases and diseases of aging such as loss of skin or organ stretch and resiliency.

Inhibition of selected MMPs can also be desirable in other instances. Treatment of cancer and/or inhibition of metastasis and/or inhibition of angiogenesis are examples of approaches to the treatment of diseases wherein the selective inhibition of stromelysin, gelatinase A or B, or collagenase III appear to be the relatively most important enzyme or enzymes to inhibit especially when compared with collagenase I (MMP-1). A drug that does not inhibit collagenase I can have a superior therapeutic profile. Osteoarthritis, another prevalent disease wherein it is believed that cartilage degradation of inflamed joints is at least partially caused by MMP-13 released from cells such as stimulated chrondrocytes, may be best treated by administration of drugs one of whose modes of action is inhibition of MMP-13. See, for example, Mitchell et al., *J. Clin. Invest.*, 97:761-768 (1996) and Reboul et al., *J. Clin. Invest.*, 97:2011-2019 (1996).

Inhibitors of metalloproteases are known. Examples include natural biochemicals such as tissue inhibitors of metalloproteinases (TIMPs), α_2-macroglobulin and their analogs or derivatives. These endogenous inhibitors are high molecular weight protein molecules that form inactive complexes with metalloproteases. A number of smaller peptide-like compounds that inhibit metalloproteases have been described. Mercaptoamide peptidyl derivatives have shown ACE inhibition *in vitro* and *in vivo*. Angiotensin converting enzyme (ACE) aids in the

production of angiotensin II, a potent pressor substance in mammals and inhibition of this enzyme leads to the lowering of blood pressure.

Thiol group-containing amide or peptidyl amide-based metalloprotease (MMP) inhibitors are known as is shown in, for example, WO95/12389, WO96/11209 and U.S. 4,595,700. Hydroxamate group-containing MMP inhibitors are disclosed in a number of published patent applications such as WO 95/29892, WO 97/24117, WO 97/49679 and EP 0 780 386 that disclose carbon back-boned compounds, and WO 90/05719, WO 93/20047, WO 95/09841 and WO 96/06074 that disclose hydroxamates that have a peptidyl back-bones or peptidomimetic back-bones, as does the article by Schwartz et al., *Progr. Med. Chem.*, *29:*271-334(1992) and those of Rasmussen et al., *Pharmacol. Ther.*, *75(1)*: 69-75 (1997) and Denis et al., *Invest. New Drugs, 15(3)*: 175-185 (1997).

One possible problem associated with known MMP inhibitors is that such compounds often exhibit the same or similar inhibitory effects against each of the MMP enzymes. For example, the peptidomimetic hydroxamate known as batimastat is reported to exhibit IC_{50} values of about 1 to about 20 nanomolar (nM) against each of MMP-1, MMP-2, MMP-3, MMP-7, and MMP-9. Marimastat, another peptidomimetic hydroxamate was reported to be another broad-spectrum MMP inhibitor with an enzyme inhibitory spectrum very similar to batimastat, except that marimastat exhibited an IC_{50} value against MMP-3 of 230 nM. Rasmussen et al., *Pharmacol. Ther.*, *75(1)*: 69-75 (1997).

Meta analysis of data from Phase I/II studies using marimastat in patients with advanced, rapidly progressive, treatment-refractory solid tumor cancers (colorectal, pancreatic, ovarian, prostate) indicated a dose-related reduction in the rise of cancer-specific antigens used as surrogate markers for biological activity. Although marimastat exhibited some measure of efficacy via these markers, toxic side effects were noted. The most common drug-related toxicity of marimastat in those clinical trials was musculoskeletal pain and stiffness, often commencing in the small joints in the hands, spreading to the arms and shoulder. A short dosing holiday of 1-3 weeks followed by dosage reduction permits treatment to continue. Rasmussen et al., *Pharmacol. Ther., 75(1)*: 69-75 (1997). It is thought that the lack of specificity of inhibitory effect among the MMPs may be the cause of that effect.

International application WO 98/38163, published on September 3, 1998 disclose a large group of hydroxamate inhibitors of MMPs and TACE. The compounds of WO 98/38163 contain one or two substituents adjacent to the hydroxamate functionality and a substituent that can be an aromatic sulfonyl group adjacent to those one or two substituents.

International application WO 98/37877, published on September 3, 1998 discloses compounds that contain a 5- to 7-membered heterocyclic ring adjacent to the hydroxamate functionality and can

contain an aromatic sulfonyl group adjacent to the heterocyclic ring.

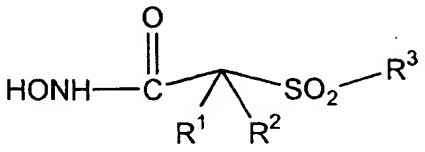
Although many of the known MMP inhibitors such as batimastat, marimastat and the hydroxamates of WO 98/37877 and WO 98/38163 exhibit a broad spectrum of activity against MMPs, those compounds are not particularly selective in their inhibitory activity. This lack of selectivity may be the cause of the musculoskeletal pain and stiffness observed with their use. In addition, it can be therapeutically advantageous to utilize a medicament that is selective in its activity as compared to a generally active material so that treatment can be more closely tailored to the pathological condition presented by the host mammal. The disclosure that follows describes a process for treating a host mammal having a condition associated with pathological matrix metalloprotease activity that utilizes a compound that selectively inhibits one or more MMPs, while exhibiting less activity against at least MMP-1.

Summary of the Invention

The present invention is directed to a treatment process that comprises administering a contemplated aromatic sulfone hydroxamic acid metalloprotease inhibitor in an effective amount to a host mammal having a condition associated with pathological metalloprotease activity. A contemplated molecule, *inter alia*, exhibits excellent inhibitory activity of one or more matrix

metalloprotease (MMP) enzymes, such as MMP-2, MMP-9 and MMP-13, while exhibiting substantially less inhibition at least of MMP-1. By "substantially less" it is meant that a contemplated compound exhibits an IC_{50} value ratio against one or more of MMP-2, MMP-9 or MMP-13 as compared to its IC_{50} value against MMP-1, e.g., IC_{50} MMP-2:IC_{50} MMP-1, that is less than about 1:10, preferably less than about 1:100, and most preferably less than about 1:1000 in the *in vitro* inhibition assay utilized hereinafter. The invention also contemplates particular compounds that selectively inhibit the activity of one or more of MMP-2, MMP-9 and MMP-13, while exhibiting substantially less inhibition at least of MMP-1, as well as a composition containing such a MMP inhibitor as active ingredient. The invention further contemplates intermediates in the preparation of a contemplated aromatic sulfone hydroxamic acid molecule and a process for preparing an aromatic sulfone hydroxamic acid molecule.

Briefly, one embodiment of the present invention is directed to a treatment process that comprises administering a contemplated aromatic sulfone hydroxamic acid metalloprotease inhibitor that selectively inhibits matrix metalloprotease activity as above in an effective amount to a host mammal having a condition associated with pathological metalloprotease activity. The administered enzyme inhibitor corresponds in structure to formula (I), below, or a pharmaceutically acceptable salt thereof:



I

wherein

R^1 and R^2 are both hydrido or R^1 and R^2 together with the atoms to which they are bonded form a 5- to 8-membered ring containing one, two or three heteroatoms in the ring that are oxygen, sulfur or nitrogen.

R^3 in formula I is an optionally substituted aryl or optionally substituted heteroaryl radical. When R^3 is a substituted aryl or heteroaryl radical, a contemplated substituent is selected from the group consisting of an aryl, heteroaryl, aralkyl, heteroaralkyl, aryloxy, arylthio, aralkoxy, heteroaralkoxy, aralkoxyalkyl, aryloxyalkyl, aralkanoylalkyl, arylcarbonylalkyl, aralkylaryl, aryloxyalkylaryl, aralkoxyaryl, arylazoaryl, arylhydrazinoaryl, alkylthioaryl, arylthioalkyl, alkylthioaralkyl, aralkylthioalkyl, an aralkylthioaryl radical, the sulfoxide or sulfone of any of the thio substituents, and a fused ring structure comprising two or more 5- or 6-membered rings selected from the group consisting of aryl, heteroaryl, carbocyclic and heterocyclic.

The substituent bonded to the aryl or heteroaryl radical of which the R^3 radical is comprised itself can be substituted with one or more substituents;

i.e., the substituting substituent is optionally substituted. When that aryl or heteroaryl radical is substituted, and the substituting moiety (group, substituent, or radical) is itself substituted, the last-named substituent is independently selected from the group consisting of a cyano, perfluoroalkyl, trifluoromethoxy, trifluoromethylthio, haloalkyl, trifluoromethylalkyl, aralkoxycarbonyl, aryloxycarbonyl, hydroxy, halo, alkyl, alkoxy, nitro, thiol, hydroxycarbonyl, aryloxy, arylthio, aralkyl, aryl, arylcarbonylamino, heteroaryloxy, heteroarylthio, heteroaralkyl, cycloalkyl, heterocyclooxy, heterocyclothio, heterocycloamino, cycloalkyloxy, cycloalkylthio, heteroaralkoxy, heteroaralkylthio, aralkoxy, aralkylthio, aralkylamino, heterocyclo, heteroaryl, arylazo, hydroxycarbonylalkoxy, alkoxycarbonylalkoxy, alkanoyl, arylcarbonyl, aralkanoyl, alkanoyloxy, aralkanoyloxy, hydroxyalkyl, hydroxyalkoxy, alkylthio, alkoxyalkylthio, alkoxycarbonyl, aryloxyalkoxyaryl, arylthioalkylthioaryl, aryloxyalkylthioaryl, arylthioalkoxyaryl, hydroxycarbonylalkoxy, hydroxycarbonylalkylthio, alkoxycarbonylalkoxy, alkoxycarbonylalkylthio, amino,

wherein the amino nitrogen is (i) unsubstituted, or (ii) substituted with one or two substituents that are independently selected from the group consisting of an alkyl, aryl, heteroaryl, aralkyl, cycloalkyl, aralkoxycarbonyl, alkoxycarbonyl, arylcarbonyl, aralkanoyl, heteroarylcarbonyl, heteroaralkanoyl and an alkanoyl group, or (iii) wherein the amino nitrogen and two substituents attached thereto

form a 5- to 8-membered heterocyclo or heteroaryl ring containing zero to two additional heteroatoms that are nitrogen, oxygen or sulfur and which ring itself is (a) unsubstituted or (b) substituted with one or two groups independently selected from the group consisting of an aryl, alkyl, heteroaryl, aralkyl, heteroaralkyl, hydroxy, alkoxy, alkanoyl, cycloalkyl, heterocycloalkyl, alkoxycarbonyl, hydroxyalkyl, trifluoromethyl, benzofused heterocycloalkyl, hydroxyalkoxyalkyl, aralkoxycarbonyl, hydroxycarbonyl, aryloxycarbonyl, benzofused heterocycloalkoxy, benzofused cycloalkylcarbonyl, heterocyclo-alkylcarbonyl, and a cycloalkylcarbonyl group, carbonylamino

wherein the carbonylamino nitrogen is (i) unsubstituted, or (ii) is the reacted amine of an amino acid, or (iii) substituted with one or two radicals selected from the group consisting of an alkyl, hydroxyalkyl, hydroxyheteroaralkyl, cycloalkyl, aralkyl, trifluoromethylalkyl, heterocycloalkyl, benzofused heterocycloalkyl, benzofused heterocycloalkyl, benzofused cycloalkyl, and an N,N-dialkylsubstituted alkylamino-alkyl group, or (iv) the carboxamido nitrogen and two substituents bonded thereto together form a 5- to 8-membered heterocyclo, heteroaryl or benzofused heterocycloalkyl ring that is itself unsubstituted or substituted with one or two radicals independently selected from the group consisting of an alkyl, alkoxycarbonyl, nitro, heterocycloalkyl,

hydroxy, hydroxycarbonyl, aryl, aralkyl, heteroaralkyl and an amino group,

wherein the amino nitrogen is (i) unsubstituted, or (ii) substituted with one or two substituents that are independently selected from the group consisting of alkyl, aryl, and heteroaryl, or (iii) wherein the amino nitrogen and two substituents attached thereto form a 5- to 8-membered heterocyclo or heteroaryl ring,

and an aminoalkyl group

wherein the aminoalkyl nitrogen is (i) unsubstituted, or (ii) substituted with one or two substituents independently selected from the group consisting of an alkyl, aryl, aralkyl, cycloalkyl, aralkoxycarbonyl, alkoxycarbonyl, and an alkanoyl group, or (iii) wherein the aminoalkyl nitrogen and two substituents attached thereto form a 5- to 8-membered heterocyclo or heteroaryl ring.

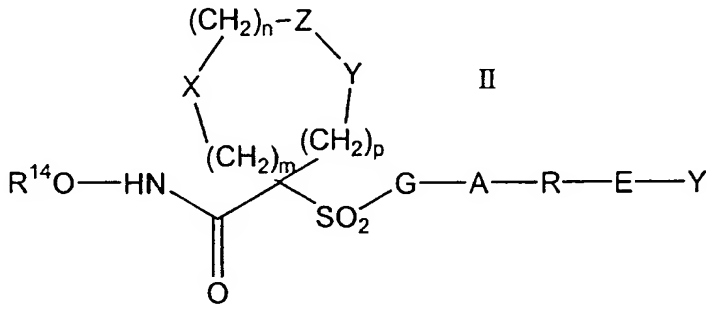
In preferred practice, R^1 and R^2 together with the atoms to which they are bonded form a 6-membered ring.

An R^3 radical preferably has a length that is greater than that of a pentyl group [a $-(CH_2)_4CH_3$ chain] and more preferably greater than about that of a hexyl group [a $-(CH_2)_5CH_3$ chain]. An R^3 radical preferably has a length that is less than that of an icosyl group [a $-(CH_2)_{19}CH_3$ chain], and more preferably a length that is less than that of a stearyl group [a $-(CH_2)_{17}CH_3$ chain). A preferred R^3 group contains two or more 5- or 6-membered rings. A

contemplated R^3 group, when rotated about an axis drawn through the SO_2-bonded 1-position and the substituent-bonded 4-position of a 6-membered ring or the SO_2-bonded 1-position and substituent-bonded 3- or 4-position of a 5-membered ring, defines a three-dimensional volume whose widest dimension has the width in a direction transverse to that axis to rotation of about one furanyl ring to about two phenyl rings.

It is also preferred that a R^3 radical be a single-ringed aryl or heteroaryl group that is 5- or 6-membered, and is itself substituted at its own 4-position when a 6-membered ring or at its own 3- or 4-position when a 5-membered ring with an optionally substituted substituent selected from the group consisting of one other single-ringed aryl or heteroaryl group, a C_3-C_{14} alkyl group, a N-piperidyl group, a N-piperazyl group, a phenoxy group, a thiophenoxy group, a 4-thiopyridyl group, a phenylazo group and a benzamido group. The substituent of the 5- or 6-membered aryl or heteroaryl group can itself be substituted as discussed before.

A preferred compound for use in a contemplated process has a structure that corresponds to formula II, below, or a pharmaceutically acceptable salt thereof:



II

wherein

R^{14} is hydrido, a pharmaceutically acceptable cation or $C(W)R^{15}$ where W is O or S and R^{15} is selected from the group consisting of an C_1-C_6-alkyl, aryl, C_1-C_6-alkoxy, heteroaryl-C_1-C_6-alkyl, C_3-C_8-cycloalkyl-C_1-C_6-alkyl, aryloxy, ar-C_1-C_6-alkoxy, ar-C_1-C_6-alkyl, heteroaryl and amino C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two substituents independently selected from the group consisting of an C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl-C_1-C_6-alkyl, ar-C_1-C_6-alkoxycarbonyl, C_1-C_6-alkoxycarbonyl, and C_1-C_6-alkanoyl radical, or (iii) wherein the amino C_1-C_6-alkyl nitrogen and two substituents attached thereto form a 5- to 8-membered heterocyclo or heteroaryl ring;

m is zero, 1 or 2;

n is zero, 1 or 2;

p is zero, 1 or 2;

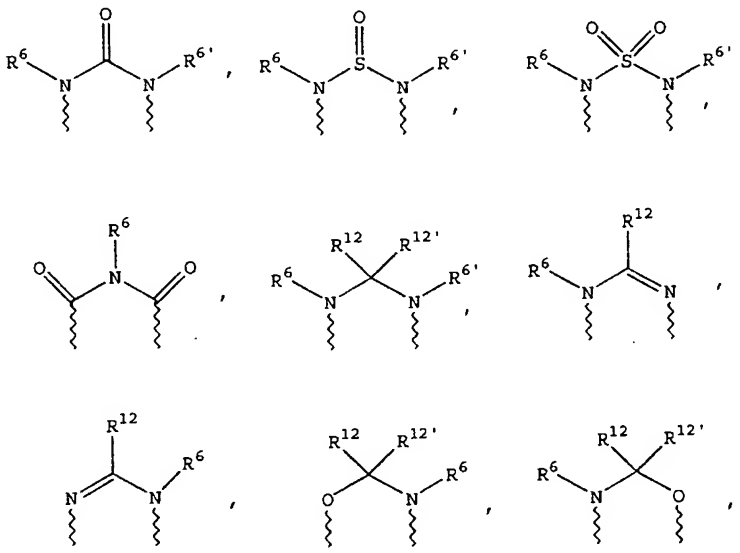
the sum of m + n + p = 1, 2, 3 or 4;

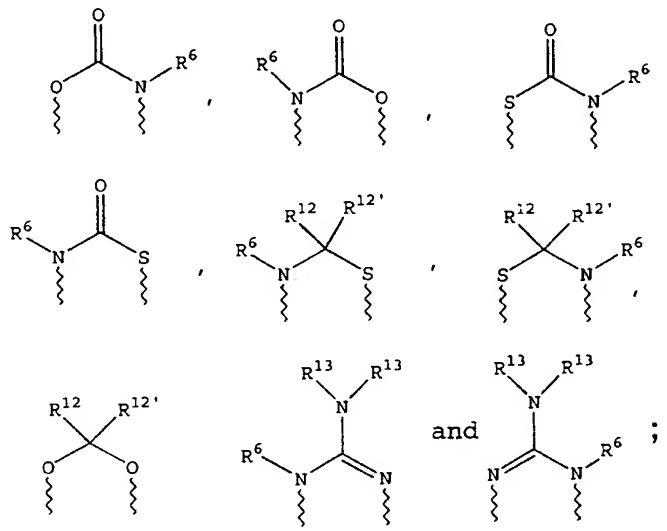
(a) one of X, Y and Z is selected from the group consisting of C(O), NR^6, O, S, S(O), $S(O)_2$ and

$NS(O)_2R^7$, and the remaining two of X, Y and Z are CR^8R^9, and $CR^{10}R^{11}$, or

(b) X and Z or Z and Y together constitute a moiety that is selected from the group consisting of $NR^6C(O)$, $NR^6S(O)$, $NR^6S(O)_2$, NR^6S, NR^6O, SS, NR^6NR^6 and OC(O), with the remaining one of X, Y and Z being CR^8R^9, or

(c) n is zero and X, Y and Z together constitute a moiety selected from the group consisting of





wherein wavy lines are bonds to the atoms of the depicted ring;

R^6 and $R^{6'}$ are independently selected from the group consisting of hydrido, C_1-C_6-alkanoyl, C_6-aryl-C_1-C_6-alkyl, aroyl, bis(C_1-C_6-alkoxy-C_1-C_6-alkyl)-C_1-C_6-alkyl, C_1-C_6-alkyl, C_1-C_6-haloalkyl, C_1-C_6-perfluoroalkyl, C_1-C_6-trifluoromethylalkyl, C_1-C_6-perfluoroalkoxy-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, C_3-C_6-cycloalkyl, C_3-C_8-heterocycloalkyl, C_3-C_8-heterocycloalkylcarbonyl, C_6-aryl, C_5-C_6-heterocyclo, C_5-C_6-heteroaryl, C_3-C_8-cycloalkyl-C_1-C_6-alkyl, C_6-aryloxy-C_1-C_6-alkyl, heteroaryloxy-C_1-C_6-alkyl, heteroaryl-C_1-C_6-alkoxy-C_1-C_6-alkyl, heteroarylthio-C_1-C_6-alkyl, C_6-arylsulfonyl, C_1-C_6-alkylsulfonyl, C_5-C_6-heteroarylsulfonyl, carboxy-C_1-C_6-alkyl, C_1-C_4-alkoxycarbonyl-C_1-C_6-alkyl, aminocarbonyl, C_1-C_6-alkyliminocarbonyl, C_6-

aryliminocarbonyl, C_5-C_6-heterocycloiminocarbonyl, C_6-arylthio-C_1-C_6-alkyl, C_1-C_6-alkylthio-C_1-C_6-alkyl, C_6-arylthio-C_3-C_6-alkenyl, C_1-C_4-alkylthio-C_3-C_6-alkenyl, C_5-C_6-heteroaryl-C_1-C_6-alkyl, halo-C_1-C_6-alkanoyl, hydroxy-C_1-C_6-alkanoyl, thiol-C_1-C_6-alkanoyl, C_3-C_6-alkenyl, C_3-C_6-alkynyl, C_1-C_4-alkoxy-C_1-C_4-alkyl, C_1-C_5-alkoxycarbonyl, aryloxycarbonyl, NR^8R^9-C_1-C_5-alkylcarbonyl, hydroxy-C_1-C_5-alkyl, an aminocarbonyl wherein the aminocarbonyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group, hydroxyaminocarbonyl, an aminosulfonyl group wherein the aminosulfonyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group, an amino-C_1-C_6-alkylsulfonyl group wherein the amino-C_1-C_6-alkylsulfonyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group and an amino-C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group;

R^7 is selected from the group consisting of a arylalkyl, aryl, heteroaryl, heterocyclo, C_1-C_6-alkyl, C_3-C_6-alkynyl, C_3-C_6-alkenyl, C_1-C_6-carboxyalkyl and a C_1-C_6-hydroxyalkyl group;

R^8 and R^9 and R^{10} and R^{11} are independently selected from the group consisting of a hydrido, hydroxy, C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl, heteroaryl, heteroar-C_1-C_6-alkyl, C_2-C_6-alkynyl, C_2-C_6-alkenyl, thiol-C_1-C_6-alkyl, C_1-C_6-alkylthio-C_1-C_6-alkyl cycloalkyl, cycloalkyl-C_1-C_6-alkyl, heterocycloalkyl-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, aralkoxy-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkoxy-C_1-C_6-alkyl, hydroxy-C_1-C_6-alkyl, hydroxycarbonyl-C_1-C_6-alkyl, hydroxycarbonylar-C_1-C_6-alkyl, aminocarbonyl-C_1-C_6-alkyl, aryloxy-C_1-C_6-alkyl, heteroaryloxy-C_1-C_6-alkyl, arylthio-C_1-C_6-alkyl, heteroarylthio-C_1-C_6-alkyl, the sulfoxide or sulfone of any said thio substituents, perfluoro-C_1-C_6-alkyl, trifluoromethyl-C_1-C_6-alkyl, halo-C_1-C_6-alkyl, alkoxycarbonylamino-C_1-C_6-alkyl and an amino-C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, cycloalkyl and C_1-C_6-alkanoyl, or wherein R^8 and R^9 or R^{10} and R^{11} and the carbon to which they are bonded form a carbonyl group, or wherein R^8 and R^9 or R^{10} and R^{11}, or R^8 and R^{10} together with the atoms to which they

are bonded form a 5- to 8-membered carbocyclic ring, or a 5- to 8-membered heterocyclic ring containing one or two heteroatoms that are nitrogen, oxygen, or sulfur, with the proviso that only one of R^8 and R^9 or R^{10} and R^{11} is hydroxy;

R^{12} and $R^{12'}$ are independently selected from the group consisting of a hydrido, C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl, heteroaryl, heteroaralkyl, C_2-C_6-alkynyl, C_2-C_6-alkenyl, thiol-C_1-C_6-alkyl, cycloalkyl, cycloalkyl-C_1-C_6-alkyl, heterocycloalkyl-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, aryloxy-C_1-C_6-alkyl, amino-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkoxy-C_1-C_6-alkyl, hydroxy-C_1-C_6-alkyl, hydroxycarbonyl-C_1-C_6-alkyl, hydroxycarbonylar-C_1-C_6-alkyl, aminocarbonyl-C_1-C_6-alkyl, aryloxy-C_1-C_6-alkyl, heteroaryloxy-C_1-C_6-alkyl, C_1-C_6-alkylthio-C_1-C_6-alkyl, arylthio-C_1-C_6-alkyl, heteroarylthio-C_1-C_6-alkyl, the sulfoxide or sulfone of any said thio substituents, perfluoro-C_1-C_6-alkyl, trifluoromethyl-C_1-C_6-alkyl, halo-C_1-C_6-alkyl, alkoxycarbonylamino-C_1-C_6-alkyl and an amino-C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, cycloalkyl and C_1-C_6-alkanoyl;

R^{13} is selected from the group consisting of a hydrido, benzyl, phenyl, C_1-C_6-alkyl, C_2-C_6-alkynyl, C_2-C_6-alkenyl and a C_1-C_6-hydroxyalkyl group; and

G-A-R-E-Y is a substituent that preferably has a length greater than that of a pentyl group, and more preferably has a length greater than that of a hexyl group. The substituent G-A-R-E-Y preferably has a length that is less than that of an icosyl group, and is more preferably less than that of a stearyl group. In this substituent:

G is an aryl or heteroaryl group;

A is selected from the group consisting of

(1) -O-;

(2) -S-;

(3) $-NR^{17}-$;

(4) $-CO-N(R^{17})$ or $-N(R^{17})-CO-$, wherein R^{17} is hydrogen, C_1-C_4-alkyl, or phenyl;

(5) -CO-O- or -O-CO-;

(6) -O-CO-O-;

(7) -HC=CH-;

(8) -NH-CO-NH-;

(9) -C≡C-;

(10) -NH-CO-O- or -O-CO-NH-;

(11) -N=N-;

(12) -NH-NH-; and

(13) $-CS-N(R^{18})-$ or $-N(R^{18})-CS-$, wherein R^{18} is hydrogen C_1-C_4-alkyl, or phenyl; or

(14) A is absent and G is bonded directly to R;

R is a moiety selected from the group consisting of alkyl, alkoxyalkyl, aryl, heteroaryl, cycloalkyl, heterocycloalkyl, aralkyl, heteroaralkyl,

heterocycloalkylalkyl, cycloalkylalkyl, cycloalkoxyalkyl, heterocycloalkoxyalkyl, aryloxyalkyl, heteroaryloxyalkyl, arylthioalkyl, heteroarylthioalkyl, cycloalkylthioalkyl, and a heterocycloalkylthioalkyl group wherein the aryl or heteroaryl or cycloalkyl or heterocycloalkyl substituent is (i) unsubstituted or (ii) substituted with one or two radicals selected from the group consisting of a halo, alkyl, perfluorcalkyl, perfluoroalkoxy, perfluoroalkylthio, trifluoromethylalkyl, amino, alkoxycarbonylalkyl, alkoxy, C_1-C_2-alkylene-dioxy, hydroxycarbonylalkyl, hydroxycarbonylalkylamino, nitro, hydroxy, hydroxyalkyl, alkanoylamino, and a alkoxycarbonyl group, and R is other than alkyl or alkoxyalkyl when A is -O- or -S-;

E is selected from the group consisting of

(1) $-CO(R^{19})-$ or $-(R^{19})CO-$, wherein R^{19} is a heterocycloalkyl, or a cycloalkyl group;

(2) -CONH- or -HNCO-; and

(3) -CO-;

(4) $-SO_2-R^{19}-$ or $-R^{19}-SO_2-$;

(5) $-SO_2-$;

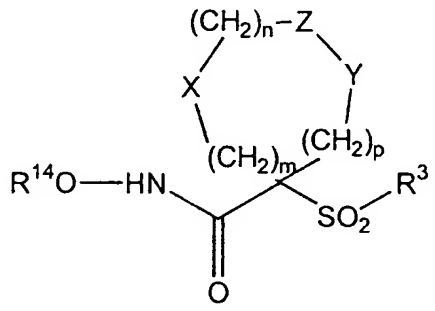
(6) $-NH-SO_2-$ or $-SO_2-NH-$; or

(7) E is absent and R is bonded directly to Y; and

Y is absent or is selected from the group consisting of a hydrido, alkyl, alkoxy, haloalkyl, aryl, aralkyl, cycloalkyl, heteroaryl, hydroxy,

aryloxy, aralkoxy, heteroaryloxy, heteroaralkyl, perfluoroalkoxy, perfluoroalkylthio, trifluoromethylalkyl, alkenyl, heterocycloalkyl, cycloalkyl, trifluoromethyl, alkoxycarbonyl, and a aminoalkyl group, wherein the aryl or heteroaryl or heterocycloalkyl group is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of an alkanoyl, halo, nitro, aralkyl, aryl, alkoxy, and an amino group wherein the amino nitrogen is (i) unsubstituted or (ii) substituted with one or two groups independently selected from hydrido, alkyl, and an aralkyl group.

A particularly preferred compound for use in a contemplated process corresponds in structure to formula III, below, or a pharmaceutically acceptable salt thereof:



III

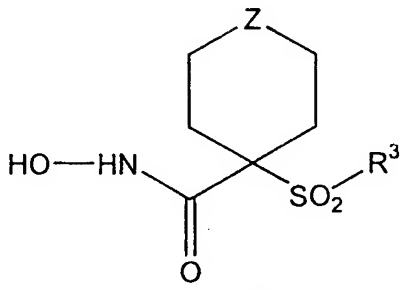
wherein

m, n, p, X, Z, Y and R^{14} are as defined above for formula II, and the R^3 radical that is defined

below is a sub-set of the previously discussed G-A-R-E-Y substituents.

Thus, R^3 is a radical that is comprised of a single-ringed aryl or heteroaryl group that is 5- or 6-membered, and is itself substituted at its own 4-position when a 6-membered ring and at its own 3- or 4-position when a 5-membered ring with a substituent selected from the group consisting of a thiophenoxy, 4-chlorophenoxy, 3-chlorophenoxy, 4-methoxyphenoxy, 3-benzodioxol-5-yloxy, 3,4-dimethylphenoxy, 4-fluorophenoxy, 4-fluorothiophenoxy, phenoxy, 4-trifluoromethoxy-phenoxy, 4-trifluoromethylphenoxy, 4-(trifluoromethylthio)-phenoxy, 4-(trifluoromethylthio)-thiophenoxy, 4-chloro-3-fluorophenoxy, 4-isopropoxyphenoxy, 4-isopropylphenoxy, (2-methyl-1,3-benzothiazol-5-yl)oxy, 4-(1H-imidazol-1-yl)phenoxy, 4-chloro-3-methylphenoxy, 3-methylphenoxy, 4-ethoxyphenoxy, 3,4-difluorophenoxy, 4-chloro-3-methylphenoxy, 4-fluoro-3-chlorophenoxy, 4-(1H-1,2,4-triazol-1-yl)phenoxy, 3,5-difluorophenoxy, 3,4-dichlorophenoxy, 4-cyclopentylphenoxy, 4-bromo-3-methylphenoxy, 4-bromophenoxy, 4-methylthiophenoxy, 4-phenylphenoxy, 4-benzylphenoxy, 6-quinolinyloxy, 4-amino-3-methylphenoxy, 3-methoxyphenoxy, 5,6,7,8-tetrahydro-2-naphthalenyloxy, 3-hydroxymethylphenoxy, N-piperidyl, N-piperazinyl and a 4-benzyloxyphenoxy group.

A more particularly preferred compound for use in a contemplated process has a structure that corresponds to formula IV, below, or a pharmaceutically acceptable salt thereof:



IV

wherein R^3 is as defined above for formula I, more preferably as defined for formula II (wherein this R^3 group is the G-A-R-E-Y substituent), and more preferably still as defined for formula III, and

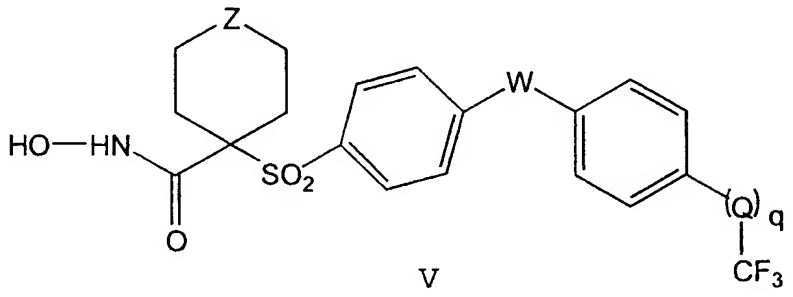
Z is selected group the group consisting of O, S, NR^6, SO, SO_2, and NSO_2R^7,

wherein R^6 is selected from the group consisting of hydrido, C_1-C_5-alkyl, C_1-C_5-alkanoyl, benzyl, benzoyl, C_3-C_5-alkynyl, C_3-C_5-alkenyl, C_1-C_3-alkoxy-C_1-C_4-alkyl, C_3-C_6-cycloalkyl, heteroaryl-C_1-C_6-alkyl, C_1-C_5-hydroxyalkyl, C_1-C_5-carboxyalkyl, C_1-C_5-alkoxy C_1-C_5-alkylcarbonyl, and NR^8R^9-C_1-C_5-alkylcarbonyl or NR^8R^9-C_1-C_5-alkyl wherein R^8 and R^9 are independently hydrido, C_1-C_5-alkyl, C_1-C_5-alkoxycarbonyl or aryl-C_1-C_5-alkoxycarbonyl, or NR^8R^9 together form a heterocyclic ring containing 5- to 8-atoms in the ring; and

R^7 is selected from the group consisting of an arylalkyl, aryl, heteroaryl, heterocyclo, C_1-C_6-

alkyl, C_3-C_6-alkynyl, C_3-C_6-alkenyl, C_1-C_6-carboxyalkyl and a C_1-C_6-hydroxyalkyl group.

A still more preferred group of compounds for use in a contemplated process correspond in structure to formula V, below, or a pharmaceutically acceptable salt thereof:



V

wherein

Z is as previously defined in formula IV;

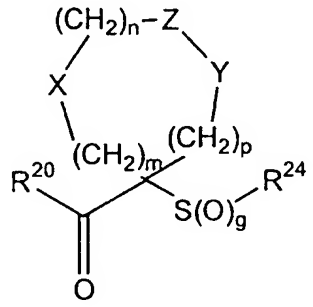
W and Q are independently oxygen (O), NR^6 or sulfur (S), and R^6 is as defined in formula IV; and

q is zero or one such that when q is zero, the trifluoromethyl group is bonded directly to the depicted phenyl ring.

The use of a compound of formulas I-V, or a pharmaceutically acceptable salt of one of those compounds is contemplated in a before-described process. In addition, the compounds of formulas II, III, IV and V, and their pharmaceutically acceptable salts are contemplated compounds of this invention.

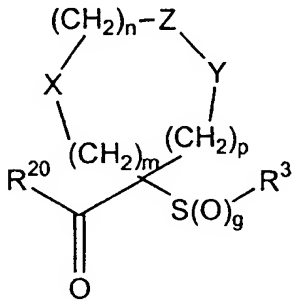
The present invention also contemplates a precursor or intermediate compound that is useful in preparing a compound of formulas I-V. Such an

intermediate compound corresponds in structure to formula VI, below:

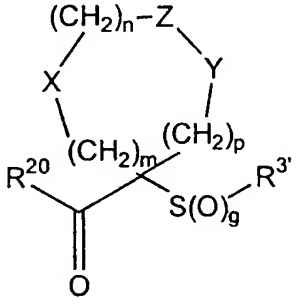


VI

wherein m, n, p, X, Z and Y are as defined above for formula II, g is zero, 1 or 2 and R^{24} is R^3 as defined in formulas I, III or IV, is the substituent G-A-R-E-Y of formula II (formula VIA) or is $R^{3'}$, an aryl or heteroaryl group that is substituted with a coupling substituent reactive for coupling with another moiety (formula VIB), such as a nucleophilically displaceable leaving group, D.



VIA



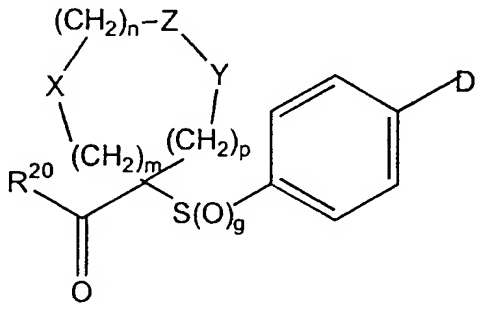
VIB

Exemplary nucleophilically displaceable leaving groups, D, include a halo (fluoro, chloro, bromo, or idodo) nitro, azido, phenylsulfoxido,

aryloxy, C_1-C_6-alkoxy, a C_1-C_6-alkylsulfonate or arylsulfonate group and a trisubstituted ammonium group in which the three substituents are independently aryl, ar- C_1-C_6-alkyl or C_1-C_6-alkyl.

R^{20} is (a) -O-R^{21}, where R^{21} is selected from the group consisting of a hydrido, C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl group and a pharmaceutically acceptable cation, or (b) -NH-O-R^{22} wherein R^{22} is a selectively removable protecting group such as a 2-tetrahydropyranyl, C_1-C_6-acyl, aroyl, benzyl, p-methoxybenzyloxycarbonyl (MOZ), benzyloxycarbonyl, C_1-C_6-alkoxycarbonyl, C_1-C_6-alkoxy-CH_2-, C_1-C_6-alkoxy-C_1-C_6-alkoxy-CH_2-, trisubstituted silyl group or o-nitrophenyl group, peptide synthesis resin and the like. Trisubstituted silyl group is substituted with C_1-C_6-alkyl, aryl, or ar-C_1-C_6-alkyl.

A particularly preferred precursor intermediate to an intermediate compound of formula VI is an intermediate compound of formula VII



VII

wherein m, n, p, g, X, Z, Y, D and R^{20} are as defined above for formula VI.

Among the several benefits and advantages of the present invention are the provision of compounds and compositions effective as inhibitors of matrix metalloproteinase activity, the provision of such compounds and compositions that are effective for the inhibition of metalloproteinases implicated in diseases and disorders involving uncontrolled breakdown of connective tissue.

More particularly, a benefit of this invention is the provision of a compound and composition effective for selectively inhibiting certain metalloproteinases, such as one or more of MMP-2, MMP-9 and MMP-13, associated with pathological conditions such as, for example, rheumatoid arthritis, osteoarthritis, septic arthritis, corneal, epidermal or gastric ulceration, tumor metastasis, invasion or angiogenesis, periodontal disease, proteinuria, Alzheimer's Disease, coronary thrombosis and bone disease.

An advantage of the invention is the provision of compounds, compositions and methods effective for treating such pathological conditions by selective inhibition of a metalloproteinase such as MMP-2, MMP-9 or MMP-13 associated with such conditions with minimal side effects resulting from inhibition of other metalloproteinases, such as MMP-1, whose activity is necessary or desirable for normal body function.

Yet another advantage of the invention is the provision of a process for preparing such compounds.

Another benefit is the provision of a method for treating a pathological condition

associated with abnormal matrix metalloproteinase activity.

A further advantage of the invention is the provision of a process for preparing such compositions.

Still further benefits and advantages of the invention will be apparent to the skilled worker from the disclosure that follows.

Detailed Description of the Invention

In accordance with the present invention, it has been discovered that certain aromatic sulfone hydroxamic acids (hydroxamates) are effective for inhibition of matrix metalloproteinases ("MMPs") believed to be associated with uncontrolled or otherwise pathological breakdown of connective tissue. In particular, it has been found that these certain aromatic sulfone hydroxamates are effective for inhibition of one or more enzymes such as MMP-2, MMP-9 and MMP-13, which can be particularly destructive to tissue if present or generated in abnormal quantities or concentrations, and thus exhibit a pathological activity. Included in that pathological activity is the assistance of tumors and tumor cells in the process of penetrating basement membrane, and developing a new or improved blood supply; i.e., angiogenesis.

Moreover, it has been discovered that these aromatic sulfone hydroxamates are selective in the inhibition of one or more of MMP-2, MMP-9 and MMP-13 without excessive inhibition of other collagenases essential to normal bodily function such as tissue turnover and repair. More particularly, it has been

found that a contemplated aromatic sulfone hydroxamate of the invention, or a pharmaceutically acceptable salt thereof, is particularly active in inhibiting of one or more of MMP-2, MMP-9 and MMP-13 in an *in vitro* assay that is predictive of *in vivo* activity. In addition, while being selective for one or more of MMP-2, MMP-9 and MMP-13, a contemplated aromatic sulfone hydroxamate, or its salt, has a limited or minimal *in vitro* inhibitory effect on MMP-1.

There is thus a substantial difference in the activity of a compound used in a contemplated process toward one or more of MMP-2, MMP-9 and MMP-13 and MMP-1. This substantial difference is assayed using the *in vitro* inhibition assay discussed in the examples. A substantial difference in activity corresponds to a compound exhibiting an IC_{50} value against one or more of MMP-2, MMP-9 and MMP-13 that is about 0.1 times that of the compound against MMP-1, and more preferably 0.01 times that against MMP-1 and most preferably 0.001 times that against MMP-1, or more. Indeed, some compounds exhibit selectivity differences measured by IC_{50} values that exceed the bounds of the assay at the number 100,000-fold. These selectivities are illustrated in the Inhibition Tables hereinafter.

Put differently, a contemplated compound can inhibit the activity of MMP-2 compared to MMP-9 or MMP-13 and MMP-1. Similarly, a contemplated compound can inhibit the activity of MMP-13 and MMP-2, while exhibiting less inhibition against MMP-1 and MMP-9. In addition, a contemplated compound can inhibit the

activity of a MMP enzyme, while having less of an effect on tumor necrosis factor release.

The advantages of the selectivity of a contemplated compound can be appreciated, without wishing to be bound by theory, by considering the therapeutic uses the compounds. For example, inhibition of MMP-1 is suggested to be undesirable due to its role as a housekeeping enzyme, helping to maintain normal connective tissue turnover and repair. Inhibition of MMP-1 can lead to toxicities or side effects such as such as joint or connective tissue deterioration and pain. On the other hand, MMP-13 has been suggested to be intimately involved in the destruction of joint components in diseases such as osteoarthritis. Thus, potent and selective inhibition of MMP-13 compared with inhibition MMP-1 is highly desirable because a MMP-13 inhibitor can have a positive effect on disease progression in a patient in addition to having an anti-inflammatory effect.

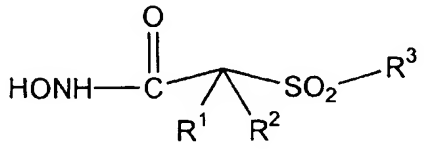
Inhibition of MMP-2 and MMP-9 can be desirable for inhibition of tumor growth, metastasis, invasion and/or angiogenesis. A profile of selective inhibition of MMP-2 and MMP-9 relative to MMP-1 can provide a therapeutic advantage.

Yet another advantage of a contemplated compound is the selectivity with respect to tumor necrosis factor release and/or tumor necrosis factor receptor release that provides the physician with another factor to help select the best drug for a particular patient. While not wishing to be bound by theory, it is believed that there are several factors to this type of selectivity to be considered.

The first is that presence of tumor necrosis factor can be desirable for the control of cancer in the organism, so long as TNF is not present in a toxic excess. Thus, uncontrolled inhibition of release of TNF can be counterproductive and actually can be considered an adverse side effect even in cancer patients. In addition, selectivity with respect to inhibition of the release of the tumor necrosis factor receptor can also be desirable. The presence of that receptor can be desirable for maintaining a controlled tumor necrosis level in the mammal by binding excess TNF.

A contemplated selective MMP inhibitor compound useful in a contemplated process can be administered to by various routes and provide adequate therapeutic blood levels of enzymatically active inhibitor. A compound can be administered, for example, by the oral (IG, PO) or intravenous (IV) routes. Oral administration is advantageous if the patient is ambulatory, not hospitalized, physically able and sufficiently responsible to take drug at the required intervals. This is true even if the person is being treated with more than one drug for one or more diseases. On the other hand, IV drug administration is an advantage in a hospital setting wherein the dose and thus the blood levels can well controlled. A contemplated inhibitor can also be formulated for IM administration if desired. This route of administration can be desirable for the administration of prodrugs or regular drug delivery to patients that are either physically weak or have a poor compliance record or require constant drug blood levels.

Thus, in one embodiment, the present invention is directed to a treatment process that comprises administering a contemplated aromatic sulfone hydroxamic acid metalloprotease inhibitor, or a pharmaceutically acceptable salt thereof, in an effective amount to a host mammal having a condition associated with pathological matrix metalloprotease activity. A contemplated aromatic sulfone hydroxamate inhibitor compound useful in such a process inhibits the activity of one or more of MMP-2, MMP-9 and MMP-13, and exhibits substantially less inhibitory activity against at least MMP-1 in the *in vitro* assay noted above and discussed in detail hereinbelow. An aromatic sulfone hydroxamate inhibitor compound for use in a contemplated process corresponds in structure to formula I, below:



I

wherein

In one embodiment, R^1 and R^2 are both hydrido. In another embodiment, R^1 and R^2 together with the atoms to which they are bonded form a 5- to 8-membered ring containing one, two or three heteroatoms in the ring that are oxygen, sulfur or nitrogen.

It is preferred that R^1 and R^2 together with the atoms to which they are bonded form a five- to eight-

membered ring that contains one or two heteroatoms in the ring, although R^1 and R^2 together with the atoms to which they are bonded form a 5- to 8-membered ring containing one, two or three heteroatoms. The heterocyclic ring can itself also be substituted with up to six C_1-C_6-alkyl groups or groups that comprise a another 5- to 8-membered carbocyclic or heterocyclic ring, an amino group, or contain one or two oxo (carbonyl) groups.

R^3 in formula I is an optionally substituted aryl or optionally substituted heteroaryl radical. That R3 radical is selected from the group consisting of an aryl, heteroaryl, aralkyl, heteroaralkyl, aralkoxy, heteroaralkoxy, aralkoxyalkyl, aryloxyalkyl, aralkanoylalkyl, arylcarbonylalkyl, aralkylaryl, aryloxyalkylaryl, aralkoxyaryl, arylazoaryl, arylhydrazinoaryl, alkylthioaryl, arylthioalkyl, alkylthioaralkyl, aralkylthioalkyl, an aralkylthioaryl radical, the sulfoxide or sulfone of any of the thio substituents, and a fused ring structure comprising two or more 5- or 6-membered rings selected from the group consisting of aryl, heteroaryl, carbocyclic and heterocyclic.

The substituent of which R^3 is comprised itself is unsubstituted or substituted with one or more substituents independently selected from the group consisting of a cyano, perfluoroalkyl, trifluoromethylalkyl, hydroxy, halo, alkyl, alkoxy, nitro, thiol, hydroxycarbonyl, aryloxy, arylthio, aralkyl, aryl, heteroaryloxy, heteroarylthio, heteroaralkyl, cycloalkyl, heterocyclooxy, heterocyclothio, heterocycloamino, cycloalkyloxy,

cycloalkylthio, heteroaralkoxy, heteroaralkylthio, aralkoxy, aralkylthio, aralkylamino, heterocyclo, heteroaryl, arylazo, hydroxycarbonylalkoxy, alkoxycarbonylalkoxy, alkanoyl, arylcarbonyl, aralkanoyl, alkanoyloxy, aralkanoyloxy, hydroxyalkyl, hydroxyalkoxy, alkylthio, alkoxyalkylthio, alkoxycarbonyl, aryloxyalkoxyaryl, arylthioalkylthioaryl, aryloxyalkylthioaryl, arylthioalkoxyaryl, hydroxycarbonylalkoxy, hydroxycarbonylalkylthio, alkoxycarbonylalkoxy, alkoxycarbonylalkylthio, amino,

wherein the amino nitrogen is (i) unsubstituted, or (ii) substituted with one or two substituents that are independently selected from the group consisting of an alkyl, aryl, heteroaryl, aralkyl, cycloalkyl, aralkoxycarbonyl, alkoxycarbonyl, arylcarbonyl, aralkanoyl, heteroarylcarbonyl, heteroaralkanoyl and an alkanoyl group, or (iii) wherein the amino nitrogen and two substituents attached thereto form a 5- to 8-membered heterocyclo or heteroaryl ring containing zero to two additional heteroatoms that are nitrogen, oxygen or sulfur and which ring itself is (a) unsubstituted or (b) substituted with one or two groups independently selected from the group consisting of an aryl, alkyl, heteroaryl, aralkyl, heteroaralkyl, hydroxy, alkoxy, alkanoyl, cycloalkyl, heterocycloalkyl, alkoxycarbonyl, hydroxyalkyl, trifluoromethyl, benzofused heterocycloalkyl, hydroxyalkoxyalkyl, aralkoxycarbonyl, hydroxycarbonyl, aryloxycarbonyl, benzofused heterocycloalkoxy,

benzofused cycloalkylcarbonyl, heterocycloalkylcarbonyl, and a cycloalkylcarbonyl group, carbonylamino

wherein the carboxamido nitrogen is (i) unsubstituted, or (ii) is the reacted amine of an amino acid, or (iii) substituted with one or two radicals selected from the group consisting of an alkyl, hydroxyalkyl, hydroxyheteroaralkyl, cycloalkyl, aralkyl, trifluoromethylalkyl, heterocycloalkyl, benzofused heterocycloalkyl, benzofused heterocycloalkyl, benzofused cycloalkyl, and an N,N-dialkylsubstituted alkylamino-alkyl group, or (iv) the carboxamido nitrogen and two substituents bonded thereto together form a 5- to 8-membered heterocyclo, heteroaryl or benzofused heterocycloalkyl ring that is itself unsubstituted or substituted with one or two radicals independently selected from the group consisting of an alkyl, alkoxycarbonyl, nitro, heterocycloalkyl, hydroxy, hydroxycarbonyl, aryl, aralkyl, heteroaralkyl and an amino group,

wherein the amino nitrogen is (i) unsubstituted, or (ii) substituted with one or two substituents that are independently selected from the group consisting of alkyl, aryl, and heteroaryl, or (iii) wherein the amino nitrogen and two substituents attached thereto form a 5- to 8-membered heterocyclo or heteroaryl ring, and an aminoalkyl group

wherein the aminoalkyl nitrogen is (i) unsubstituted, or (ii) substituted with one or two substituents independently selected from the group consisting of an alkyl, aryl, aralkyl, cycloalkyl, aralkoxycarbonyl, alkoxycarbonyl, and an alkanoyl group, or (iii) wherein the aminoalkyl nitrogen and two substituents attached thereto form a 5- to 8-membered heterocyclo or heteroaryl ring. A compound of formula I can also be used in the form of a pharmaceutically acceptable salt.

The R^3 radical has a length that is greater than that of a pentyl group [a $-(CH_2)_4CH_3$ chain], and is more preferably greater than about the length of a hexyl group [a $-(CH_2)_5CH_3$ chain]. A R^3 group has a length that is less than that of an icosyl group [eicosyl; a $-(CH_2)_{19}CH_3$ chain), and more preferably, a length that is less than that of a stearyl group [a $-(CH_2)_{17}CH_3$ chain). When rotated about an axis drawn through the SO_2-bonded 1-position and the substituent-bonded 4-position of a 6-membered ring or the SO_2-bonded 1-position and substituent-bonded 3- or 4-position of a 5-membered ring, a contemplated R^3 radical defines a three-dimensional volume whose widest dimension has the width of about one furanyl ring to about two phenyl rings in a direction transverse to that axis to rotation.

Where the SO_2-linked R^3 radical is 4-phenoxyphenyl for purposes of illustration, a contemplated compound can be viewed as a phenoxyphenylsulfone derivative of the desired 5- to

8-membered ring N-hydroxycarboxamide. Exemplary compounds can therefore be named:

N-hydroxy-1-methyl-[4-(phenoxyphenylsulfonyl)]-4-piperidinecarboxamide,

N-hydroxy-[4-(phenoxyphenylsulfonyl)]tetrahydro-2H-pyran-4-carboxamide,

N-hydroxy-1-methyl-[2,6-dioxo-4-(phenoxyphenylsulfonyl)]-4-piperidinecarboxamide,

N-hydroxy-2,2-dimethyl-[5-(phenoxyphenyl-sulfonyl)]-1,3-dioxane-5-carboxamide,

N-hydroxy-1,2-dimethyl-6-oxo-[4-(phenoxyphenyl-sulfonyl)]-4-piperidinecarboxamide,

N-hydroxy-2,2,6,6,tetramethyl-[4-(phenoxyphenyl-sulfonyl)]-4-piperidinecarboxamide,

N-hydroxy-1,3-dimethyl-[5-(phenoxyphenyl-sulfonyl)]-hexahydro-5-pyrimidinecarboxamide,

2-amino-N-hydroxy-[5-(phenoxyphenylsulfonyl)]-1,4,5,6-tetrahydro-5-pyrimidinecarboxamide,

N-hydroxy-1,1-dioxo-[4-(phenoxyphenylsulfonyl)]-1(λ6),2,6-thiadizinane-4-carboxamide,

N-hydroxy-2-oxo-[5-(phenoxyphenylsulfonyl)]-hexahydro-5-pyrimidinecarboxamide,

N-hydroxy-[2-(phenoxyphenylsulfonyl)]tetrahydro-2-furancarboxamide,

N-hydroxy-1-methyl-[2-(phenoxyphenylsulfonyl)]-2-pyrrolidinecarboxamide,

N-hydroxy-2-methyl-[4-(phenoxyphenylsulfonyl)]-4-piperidinecarboxamide,

N-hydroxy-[3-(phenoxyphenylsulfonyl)]-8-azabicyclo[3.2.1]octane-3-carboxamide,

N-hydroxy-1,1-dioxo-[4-(phenoxyphenylsulfonyl)]-hexahydro-1(lambda6)-thiopyran-4-carboxamide,

N-hydroxy-[3-(phenoxyphenylsulfonyl)]tetrahydro-3-furancarboxamide,

N-hydroxy-[3-(phenoxyphenylsulfonyl)]-3-pyrrolidinecarboxamide,

N-hydroxy-4-[[4-(phenylthio)phenyl]sulfonyl]-1-(2-propynyl)-4-piperidinecarboxamide, monohydrochloride,

N-hydroxy-4-[[4-(phenylthio)phenyl]sulfonyl]-1-(2-propynyl)-4-piperidinecarboxamide, monomethanesulfonate,

tetrahydro-N-hydroxy-4-[[4-[4-[(trifluoromethyl]phenoxy]phenyl]-sulfonyl]-2H-pyran-4-carboxamide,

N-hydroxy-1-(4-pyridinylmethyl)-4-[[4-[4-(trifluoromethyl)phenoxy]phenyl]-sulfonyl]-4-piperidinecarboxamide, hydrochloride,

N-hydroxy-1-(3-pyridinylmethyl)-4-[[4-[4-trifluoromethyl)phenoxy]phenyl]-sulfonyl]-4-piperidinecarboxamide, dihydrochloride,

N-hydroxy-1-(2-pyridinylmethyl)-4-[[4-[4-(trifluoromethyl)phenoxy]phenyl]-sulfonyl]-4-piperidinecarboxamide, dihydrochloride,

hydroxy-1-(3-pyridinylmethyl)-4-[[4-[4-(trifluoromethoxy)phenoxy]phenyl]-sulfonyl]-4-piperidinecarboxamide, dihydrochloride,

N-hydroxy-1-(2-methoxyethyl)-4-[[4-[4-(trifluoromethoxy)phenoxy]phenyl]sulfonyl}-4-piperidinecarboxamide, monohydrochloride,

N-hydroxy-1-(2-methoxyethyl)-4-[[4-[4-(trifluoromethyl)phenoxy]phenyl]sulfonyl}-4-piperidinecarboxamide, monohydrochloride,

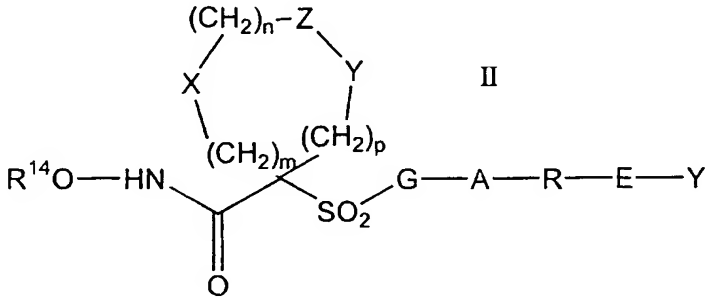
N-hydroxy-1-(2-methoxyethyl)-4-[[4-[4-[(trifluoromethyl)thio]phenoxy]phenyl]sulfonyl]-4-piperidinecarboxamide, monohydrochloride,

1-cyclopropyl-N-hydroxy-4-[[4-[4-(trifluoromethyl)phenoxy]phenyl]sulfonyl]-4-piperidinecarboxamide, monohydrochloride, and the like.

Several exemplary R^1 and R^2 groups that together form a contemplated heterocyclic ring are shown in the Tables that follow hereinafter, as well as in the descriptions of those 5- to 8-membered rings and the specific Examples, as are several contemplated aromatic sulfone hydroxamic acid compounds.

In more preferred practice, R^1 and R^2 of formula I together with the atom to which they are bonded form a 5- to 8-membered ring that contains one, two or three heteroatoms. Most preferably, that ring is a 6-membered ring that contains one heteroatom located at the 4-position relative to the position at which the SO_2 group is bonded. Other preferred compounds for use in a contemplated process correspond in structure to one or more of formulas II, III, IV or V, which are discussed hereinafter.

In one embodiment, a preferred compound used in a contemplated process has a structure that corresponds to formula II, below:



II

wherein

R^{14} is hydrido, a pharmaceutically acceptable cation or $C(W)R^{15}$ where W is O or S and R^{15} is selected from the group consisting of an C_1-C_6-alkyl, aryl, C_1-C_6-alkoxy, heteroaryl-C_1-C_6-alkyl, C_3-C_8-cycloalkyl-C_1-C_6-alkyl, aryloxy, ar-C_1-C_6-alkoxy, ar-C_1-C_6-alkyl, heteroaryl and amino C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two substituents independently selected from the group consisting of an C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl-C_1-C_6-alkyl, ar-C_1-C_6-alkoxycarbonyl, C_1-C_6-alkoxycarbonyl, and C_1-C_6-alkanoyl radical, or (iii) wherein the amino C_1-C_6-alkyl nitrogen and two substituents attached thereto form a 5- to 8-membered heterocyclo or heteroaryl ring;

m is zero, 1 or 2;

n is zero, 1 or 2;

p is zero, 1 or 2;

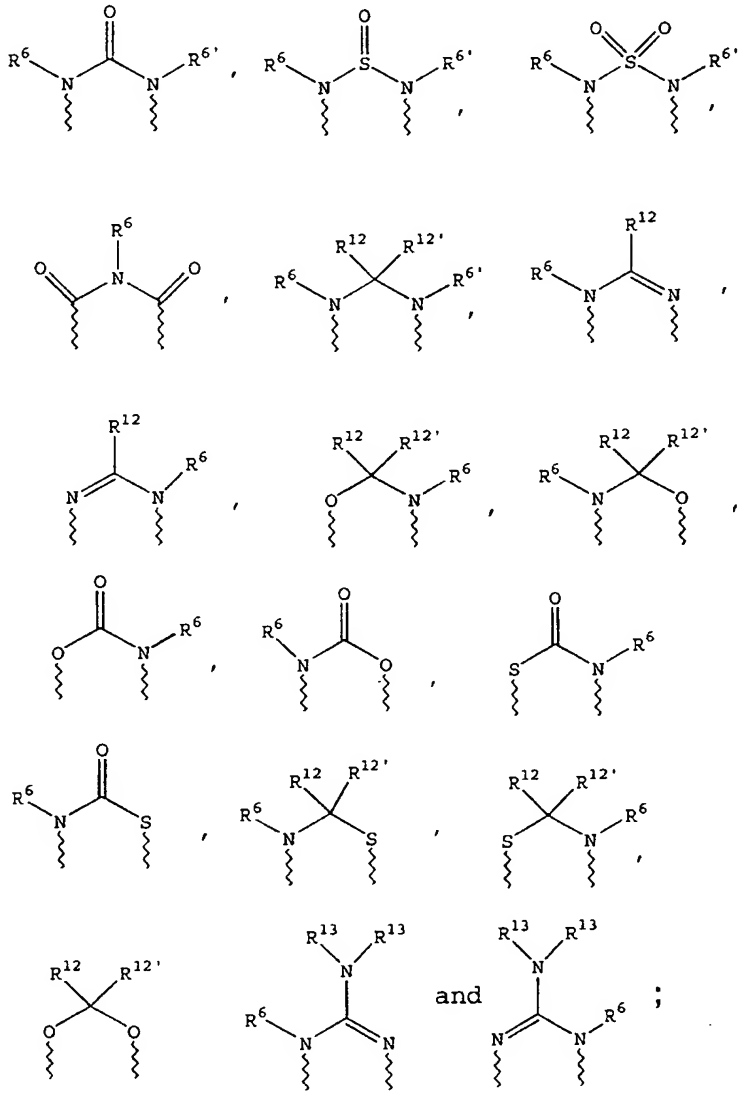
the sum of m + n + p = 1, 2, 3 or 4;

(a) one of X, Y and Z is selected from the group consisting of C(O), NR^6, O, S, S(O), $S(O)_2$ and $NS(O)_2R^7$, and the remaining two of X, Y and Z are CR^8R^9, and $CR^{10}R^{11}$, or

(b) X and Z or Z and Y together constitute a moiety that is selected from the group consisting of $NR^6C(O)$, $NR^6S(O)$, $NR^6S(O)_2$, NR^6S, NR^6O, SS, NR^6NR^6

and OC(O), with the remaining one of X, Y and Z being CR^8R^9, or

(c) n is zero and X, Y and Z together constitute a moiety selected from the group consisting of



wherein wavy lines are bonds to the atoms of the depicted ring;

R^6 and $R^{6'}$ are independently selected from the group consisting of hydrido, C_1-C_6-alkanoyl, C_6-aryl-C_1-C_6-alkyl, aroyl, bis(C_1-C_6-alkoxy-C_1-C_6-alkyl)-C_1-C_6-alkyl, C_1-C_6-alkyl, C_1-C_6-haloalkyl, C_1-C_6-perfluoroalkyl, C_1-C_6-trifluoromethylalkyl, C_1-C_6-perfluoroalkoxy-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, C_3-C_6-cycloalkyl, C_3-C_8-heterocycloalkyl, C_3-C_8-heterocycloalkylcarbonyl, C_6-aryl, C_5-C_6-heterocyclo, C_5-C_6-heteroaryl, C_3-C_8-cycloalkyl-C_1-C_6-alkyl, C_6-aryloxy-C_1-C_6-alkyl, heteroaryloxy-C_1-C_6-alkyl, heteroaryl-C_1-C_6-alkoxy-C_1-C_6-alkyl, heteroarylthio-C_1-C_6-alkyl, C_6-arylsulfonyl, C_1-C_6-alkylsulfonyl, C_5-C_6-heteroarylsulfonyl, carboxy-C_1-C_6-alkyl, C_1-C_4-alkoxycarbonyl-C_1-C_6-alkyl, aminocarbonyl, C_1-C_6-alkyliminocarbonyl, C_6-aryliminocarbonyl, C_5-C_6-heterocycloiminocarbonyl, C_6-arylthio-C_1-C_6-alkyl, C_1-C_6-alkylthio-C_1-C_6-alkyl, C_6-arylthio-C_3-C_6-alkenyl, C_1-C_4-alkylthio-C_3-C_6-alkenyl, C_5-C_6-heteroaryl-C_1-C_6-alkyl, halo-C_1-C_6-alkanoyl, hydroxy-C_1-C_6-alkanoyl, thiol-C_1-C_6-alkanoyl, C_3-C_6-alkenyl, C_3-C_6-alkynyl, C_1-C_4-alkoxy-C_1-C_4-alkyl, C_1-C_5-alkoxycarbonyl, aryloxycarbonyl, NR^8R^9-C_1-C_5-alkylcarbonyl, hydroxy-C_1-C_5-alkyl, an aminocarbonyl wherein the aminocarbonyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group,

hydroxyaminocarbonyl, an aminosulfonyl group wherein the aminosulfonyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group, an amino-C_1-C_6-alkylsulfonyl group wherein the amino-C_1-C_6-alkylsulfonyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group and an amino-C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group;

R^7 is selected from the group consisting of a benzyl, phenyl, C_1-C_6-alkyl, C_3-C_6-alkynyl, C_3-C_6-alkenyl and a C_1-C_6-hydroxyalkyl group;

R^8 and R^9 and R^{10} and R^{11} are independently selected from the group consisting of a hydrido, hydroxy, C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl, heteroaryl, heteroar-C_1-C_6-alkyl, C_2-C_6-alkynyl, C_2-C_6-alkenyl, thiol-C_1-C_6-alkyl, C_1-C_6-alkylthio-C_1-C_6-alkyl cycloalkyl, cycloalkyl-C_1-C_6-alkyl, heterocycloalkyl-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, aralkoxy-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkoxy-C_1-C_6-alkyl, hydroxy-C_1-C_6-alkyl, hydroxycarbonyl-C_1-C_6-alkyl, hydroxycarbonylar-C_1-C_6-

alkyl, aminocarbonyl-C_1-C_6-alkyl, aryloxy-C_1-C_6-alkyl, heteroaryloxy-C_1-C_6-alkyl, arylthio-C_1-C_6-alkyl, heteroarylthio-C_1-C_6-alkyl, the sulfoxide or sulfone of any said thio substituents, perfluoro-C_1-C_6-alkyl, trifluoromethyl-C_1-C_6-alkyl, halo-C_1-C_6-alkyl, alkoxycarbonylamino-C_1-C_6-alkyl and an amino-C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, cycloalkyl and C_1-C_6-alkanoyl, or wherein R^8 and R^9 or R^{10} and R^{11} and the carbon to which they are bonded form a carbonyl group, or wherein R^8 and R^9 or R^{10} and R^{11}, or R^8 and R^{10} together with the atoms to which they are bonded form a 5- to 8-membered carbocyclic ring, or a 5- to 8-membered heterocyclic ring containing one or two heteroatoms that are nitrogen, oxygen, or sulfur, with the proviso that only one of R^8 and R^9 or R^{10} and R^{11} is hydroxy;

R^{12} and $R^{12'}$ are independently selected from the group consisting of a hydrido, C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl, heteroaryl, heteroaralkyl, C_2-C_6-alkynyl, C_2-C_6-alkenyl, thiol-C_1-C_6-alkyl, cycloalkyl, cycloalkyl-C_1-C_6-alkyl, heterocycloalkyl-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, aryloxy-C_1-C_6-alkyl, amino-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkoxy-C_1-C_6-alkyl, hydroxy-C_1-C_6-alkyl, hydroxycarbonyl-C_1-C_6-alkyl, hydroxycarbonylar-C_1-C_6-alkyl,

aminocarbonyl-C_1-C_6-alkyl, aryloxy-C_1-C_6-alkyl, heteroaryloxy-C_1-C_6-alkyl, C_1-C_6-alkylthio-C_1-C_6-alkyl, arylthio-C_1-C_6-alkyl, heteroarylthio-C_1-C_6-alkyl, the sulfoxide or sulfone of any said thio substituents, perfluoro-C_1-C_6-alkyl, trifluoromethyl-C_1-C_6-alkyl, halo-C_1-C_6-alkyl, alkoxycarbonylamino-C_1-C_6-alkyl and an amino-C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, cycloalkyl and C_1-C_6-alkanoyl;

R^{13} is selected from the group consisting of a hydrido, benzyl, phenyl, C_1-C_6-alkyl, C_2-C_6-alkynyl, C_2-C_6-alkenyl and a C_1-C_6-hydroxyalkyl group; and

G-A-R-E-Y is a substituent that preferably has a length greater than that of a pentyl group, and more preferably has a length greater than that of a hexyl group. The substituent G-A-R-E-Y preferably has a length that is less than that of an icosyl group, and is more preferably less than that of a stearyl group. In this substituent:

G is an aryl or heteroaryl group;

A is selected from the group consisting of

(1) -O-;

(2) -S-;

(3) $-NR^{17}-$;

(4) $-CO-N(R^{17})$ or $-N(R^{17})-CO-$, wherein R^{17} is hydrogen, C_1-C_4-alkyl, or phenyl;

(5) -CO-O- or -O-CO-;

(6) -O-CO-O-;

(7) -HC=CH-;

(8) -NH-CO-NH-;

(9) -C≡C-;

(10) -NH-CO-O- or -O-CO-NH-;

(11) -N=N-;

(12) -NH-NH-; and

(13) -CS-N(R^{18})- or -N(R^{18})-CS-, wherein R^{18} is hydrogen C_1-C_4-alkyl, or phenyl; or

(14) A is absent and G is bonded directly to R;

R is a moiety selected from the group consisting of alkyl, alkoxyalkyl, aryl, heteroaryl, cycloalkyl, heterocycloalkyl, aralkyl, heteroaralkyl, heterocycloalkylalkyl, cycloalkylalkyl, cycloalkoxyalkyl, heterocycloalkoxyalkyl, aryloxyalkyl, heteroaryloxyalkyl, arylthioalkyl, heteroarylthioalkyl, cycloalkylthioalkyl, and a heterocycloalkylthioalkyl group wherein the aryl or heteroaryl or cycloalkyl or heterocycloalkyl substituent is (i) unsubstituted or (ii) substituted with one or two radicals selected from the group consisting of a halo, alkyl, perfluoroalkyl, perfluoroalkoxy, perfluoroalkylthio, trifluoromethylalkyl, amino, alkoxycarbonylalkyl, alkoxy, C_1-C_2-alkylene-dioxy, hydroxycarbonylalkyl, hydroxycarbonylalkylamino, nitro, hydroxy, hydroxyalkyl, alkanoylamino, and a alkoxycarbonyl

group, and R is other than alkyl or alkoxyalkyl when A is -O- or -S-;

E is selected from the group consisting of

(1) $-CO(R^{19})-$ or $-(R^{19})CO-$, wherein R^{19} is a heterocycloalkyl, or a cycloalkyl group;

(2) -CONH- or -HNCO-; and

(3) -CO-;

(4) $-SO_2-R^{19}-$ or $-R^{19}-SO_2-$;

(5) $-SO_2-$;

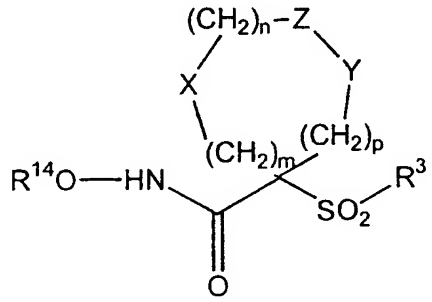
(6) $-NH-SO_2-$ or $-SO_2-NH-$; or

(7) E is absent and R is bonded directly to Y; and

Y is absent or is selected from the group consisting of a hydrido, alkyl, alkoxy, haloalkyl, aryl, aralkyl, cycloalkyl, heteroaryl, hydroxy, aryloxy, aralkoxy, heteroaryloxy, heteroaralkyl, perfluoroalkoxy, perfluoroalkylthio, trifluoromethylalkyl, alkenyl, heterocycloalkyl, cycloalkyl, trifluoromethyl, alkoxycarbonyl, and a aminoalkyl group, wherein the aryl or heteroaryl or heterocycloalkyl group is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of an alkanoyl, halo, nitro, aralkyl, aryl, alkoxy, and an amino group wherein the amino nitrogen is (i) unsubstituted or (ii) substituted with one or two groups independently selected from hydrido, alkyl, and an aralkyl group.

The substituent -G-A-R-E-Y preferably contains two to four carbocyclic or heterocyclic rings, including the aryl or heteroaryl group, G. More preferably, each of those rings is 6-membered. Additional separate preferences for a compound of formula II include: (a) that A is -O- or -S-, (b) R is an aryl, heteroaryl, cycloalkyl or heterocycloalkyl group, (c) E is absent, and (d) Y is selected from the group consisting of hydrido, an alkyl, alkoxy, perfluoroalkoxy and a perfluoroalkylthio group.

A more preferred compound for use in a contemplated process has a structure that corresponds to formula III, below:



III

wherein R^3 is a single-ringed aryl or heteroaryl group that is 5- or 6-membered, and is itself substituted at its own 4-position when a 6-membered ring and at its own 3- or 4-position when a 5-membered ring with a substituent selected from the group consisting of a thiophenoxy, 4-chlorophenoxy, 3-chlorophenoxy, 4-methoxyphenoxy, 3-benzodioxol-5-yloxy, 3,4-dimethylphenoxy, 4-fluorophenoxy, 4-fluorothiophenoxy, phenoxy, 4-trifluoro-

methoxyphenoxy, 4-trifluoromethylphenoxy, 4-(trifluoromethylthio)phenoxy, 4-(trifluoromethylthio)thiophenoxy, 4-chloro-3-fluorophenoxy, 4-isopropoxyphenoxy, 4-isopropylphenoxy, (2-methyl-1,3-benzothiazol-5-yl)oxy, 4-(1H-imidazol-1-yl)phenoxy, 4-chloro-3-methylphenoxy, 3-methyl-phenoxy, 4-ethoxyphenoxy, 3,4-difluorophenoxy, 4-chloro-3-methylphenoxy, 4-fluoro-3-chlorophenoxy, 4-(1H-1,2,4-triazol-1-yl)phenoxy, 3,5-difluorophenoxy, 3,4-dichlorophenoxy, 4-cyclopentylphenoxy, 4-bromo-3-methylphenoxy, 4-bromophenoxy, 4-methylthiophenoxy, 4-phenylphenoxy, 4-benzylphenoxy, 6-quinolinyloxy, 4-amino-3-methylphenoxy, 3-methoxyphenoxy, 5,6,7,8-tetrahydro-2-naphthalenyloxy, 3-hydroxymethylphenoxy, and a 4-benzyloxyphenoxy group;

R^{14} is hydrido, a pharmaceutically acceptable cation or $C(W)R^{15}$ where W is O or S and R^{15} is selected from the group consisting of an C_1-C_6-alkyl, aryl, C_1-C_6-alkoxy, heteroaryl-C_1-C_6-alkyl, C_3-C_8-cycloalkyl-C_1-C_6-alkyl, aryloxy, ar-C_1-C_6-alkoxy, ar-C_1-C_6-alkyl, heteroaryl and amino C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two substituents independently selected from the group consisting of an C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl-C_1-C_6-alkyl, ar-C_1-C_6-alkoxycarbonyl, C_1-C_6-alkoxycarbonyl, and a C_1-C_6-alkanoyl radical, or (iii) wherein the amino C_1-C_6-alkyl nitrogen and two substituents attached thereto

form a 5- to 8-membered heterocyclo or heteroaryl ring;

m is zero, 1 or 2;

n is zero, 1 or 2;

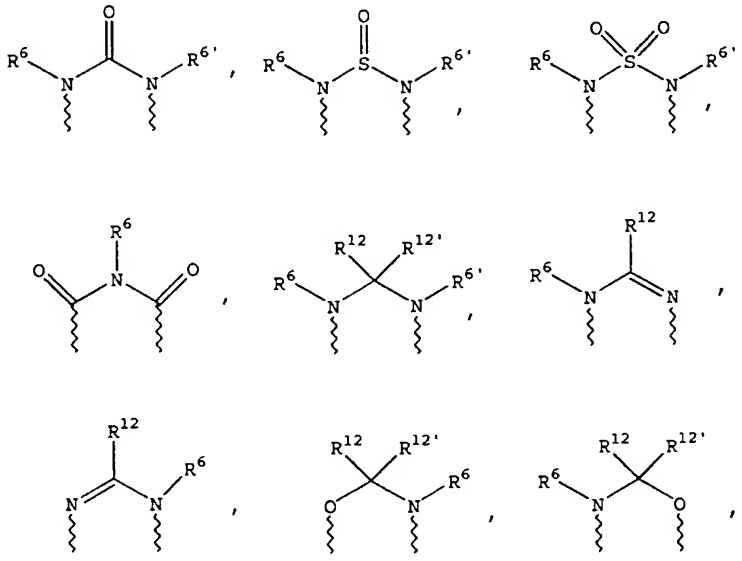
p is zero, 1 or 2;

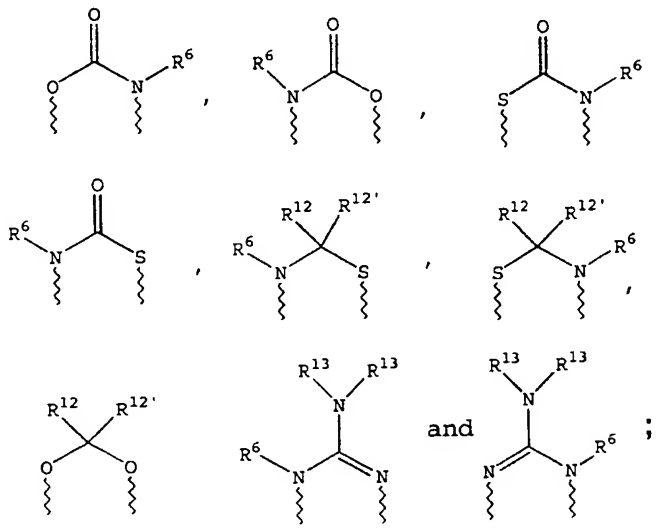
the sum of m + n + p = 1, 2, 3 or 4;

(a) one of X, Y and Z is selected from the group consisting of C(O), NR^6, O, S, S(O), $S(O)_2$ and $NS(O)_2R^7$, and the remaining two of X, Y and Z are CR^8R^9, and $CR^{10}R^{11}$, or

(b) X and Z or Z and Y together constitute a moiety that is selected from the group consisting of $NR^6C(O)$, $NR^6S(O)$, $NR^6S(O)_2$, NR^6S, NR^6O, SS, NR^6NR^6 and OC(O), with the remaining one of X, Y and Z being CR^8R^9, or

(c) n is zero and X, Y and Z together constitute a moiety selected from the group consisting of





wherein wavy lines are bonds to the atoms of the depicted ring;

R^6 and $R^{6'}$ are independently selected from the group consisting of hydrido, C_1-C_6-alkanoyl, C_6-aryl-C_1-C_6-alkyl, aroyl, bis(C_1-C_6-alkoxy-C_1-C_6-alkyl)-C_1-C_6-alkylC_1-C_6-alkyl, C_1-C_6-haloalkyl, C_1-C_6-perfluoroalkyl, C_1-C_6-trifluoromethylalkyl, C_1-C_6-perfluoroalkoxy-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, C_3-C_6-cycloalkyl, C_3-C_8-heterocycloalkyl, C_3-C_8-heterocycloalkylcarbonyl, C_6-aryl, C_5-C_6-heterocyclo, C_5-C_6-heteroaryl, C_3-C_8-cycloalkyl-C_1-C_6-alkyl, C_6-aryloxy-C_1-C_6-alkyl, heteroaryloxy-C_1-C_6-alkyl, heteroaryl-C_1-C_6-alkoxy-C_1-C_6-alkyl, heteroarylthio-C_1-C_6-alkyl, C_6-arylsulfonyl, C_1-C_6-alkylsulfonyl, C_5-C_6-heteroarylsulfonyl, carboxy-C_1-C_6-alkyl, C_1-C_4-alkoxycarbonyl-C_1-C_6-alkyl, aminocarbonyl, C_1-C_6-alkyliminocarbonyl, C_6-

aryliminocarbonyl, C_5-C_6-heterocycloiminocarbonyl, C_6-arylthio-C_1-C_6-alkyl, C_1-C_6-alkylthio-C_1-C_6-alkyl, C_6-arylthio-C_3-C_6-alkenyl, C_1-C_4-alkylthio-C_3-C_6-alkenyl, C_5-C_6-heteroaryl-C_1-C_6-alkyl, halo-C_1-C_6-alkanoyl, hydroxy-C_1-C_6-alkanoyl, thiol-C_1-C_6-alkanoyl, C_3-C_6-alkenyl, C_3-C_6-alkynyl, C_1-C_4-alkoxy-C_1-C_4-alkyl, C_1-C_5-alkoxycarbonyl, aryloxycarbonyl, NR^8R^9-C_1-C_5-alkylcarbonyl, hydroxy-C_1-C_5-alkyl, an aminocarbonyl wherein the aminocarbonyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group, hydroxyaminocarbonyl, an aminosulfonyl group wherein the aminosulfonyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group, an amino-C_1-C_6-alkylsulfonyl group wherein the amino-C_1-C_6-alkylsulfonyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group and an amino-C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group;

R^7 is selected from the group consisting of a benzyl, phenyl, C_1-C_6-alkyl, C_3-C_6-alkynyl, C_3-C_6-alkenyl and a C_1-C_6-hydroxyalkyl group;

R^8 and R^9 and R^{10} and R^{11} are independently selected from the group consisting of a hydrido, hydroxy, C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl, heteroaryl, heteroar-C_1-C_6-alkyl, C_2-C_6-alkynyl, C_2-C_6-alkenyl, thiol-C_1-C_6-alkyl, C_1-C_6-alkylthio-C_1-C_6-alkyl cycloalkyl, cycloalkyl-C_1-C_6-alkyl, heterocycloalkyl-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, aralkoxy-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkoxy-C_1-C_6-alkyl, hydroxy-C_1-C_6-alkyl, hydroxycarbonyl-C_1-C_6-alkyl, hydroxycarbonylar-C_1-C_6-alkyl, aminocarbonyl-C_1-C_6-alkyl, aryloxy-C_1-C_6-alkyl, heteroaryloxy-C_1-C_6-alkyl, arylthio-C_1-C_6-alkyl, heteroarylthio-C_1-C_6-alkyl, the sulfoxide or sulfone of any said thio substituents, perfluoro-C_1-C_6-alkyl, trifluoromethyl-C_1-C_6-alkyl, halo-C_1-C_6-alkyl, alkoxycarbonylamino-C_1-C_6-alkyl and an amino-C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, cycloalkyl and C_1-C_6-alkanoyl, or wherein R^8 and R^9 or R^{10} and R^{11} and the carbon to which they are bonded form a carbonyl group, or wherein R^8 and R^9 or R^{10} and R^{11}, or R^8 and R^{10} together with the atoms to which they are bonded form a 5- to 8-membered carbocyclic ring,

or a 5- to 8-membered heterocyclic ring containing one or two heteroatoms that are nitrogen, oxygen, or sulfur, with the proviso that only one of R^8 and R^9 or R^{10} and R^{11} is hydroxy;

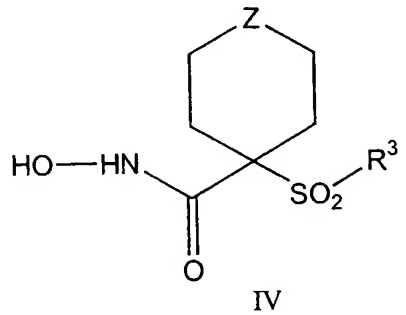
R^{12} and $R^{12'}$ are independently selected from the group consisting of a hydrido, C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl, heteroaryl, heteroaralkyl, C_2-C_6-alkynyl, C_2-C_6-alkenyl, thiol-C_1-C_6-alkyl, cycloalkyl, cycloalkyl-C_1-C_6-alkyl, heterocycloalkyl-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, aryloxy-C_1-C_6-alkyl, amino-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkoxy-C_1-C_6-alkyl, hydroxy-C_1-C_6-alkyl, hydroxycarbonyl-C_1-C_6-alkyl, hydroxycarbonylar-C_1-C_6-alkyl, aminocarbonyl-C_1-C_6-alkyl, aryloxy-C_1-C_6-alkyl, heteroaryloxy-C_1-C_6-alkyl, C_1-C_6-alkylthio-C_1-C_6-alkyl, arylthio-C_1-C_6-alkyl, heteroarylthio-C_1-C_6-alkyl, the sulfoxide or sulfone of any said thio substituents, perfluoro-C_1-C_6-alkyl, trifluoromethyl-C_1-C_6-alkyl, halo-C_1-C_6-alkyl, alkoxycarbonylamino-C_1-C_6-alkyl and an amino-C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, cycloalkyl and C_1-C_6-alkanoyl; and

R^{13} is selected from the group consisting of a hydrido, benzyl, phenyl, C_1-C_6-alkyl, C_2-C_6-alkynyl, C_2-C_6-alkenyl and a C_1-C_6-hydroxyalkyl group. Again, the use of a compound of formula III as a

pharmaceutically acceptable salt is also contemplated.

Preferences related to a compound of formula III that also apply to a compound of formula II include the following, which are independently preferred: (a) the sum of m + n + p = 1 or 2, and more preferably 2; (b) Z is O, S or NR^6; (c) R^6 is selected from the group consisting of C_3-C_6-cycloalkyl, C_1-C_6-alkyl, C_3-C_6-alkenyl, C_3-C_6-alkynyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, amino-C_1-C_6-alkyl, aminosulfonyl, heteroaryl-C_1-C_6-alkyl, aryloxycarbonyl, and C_1-C_6-alkoxycarbonyl; and (d) m = n =zero, p = 1, and Y is NR^6. Another preference for a compound of both of formulas II and III is that R^{14} be hydrido, or that W of the $C(W)R^{15}$ pro-drug form be O and R^{15} be a C_1-C_6-alkyl, aryl, C_1-C_6-alkoxy, heteroaryl-C_1-C_6-alkyl, C_3-C_8-cycloalkyl-C_1-C_6-alkyl, or aryloxy group.

A still more preferred compound for use in a contemplated process corresponds in structure to formula IV, below:



IV

Here, R^3 is as defined above as to formulas I, III and more preferably as defined as to formula II

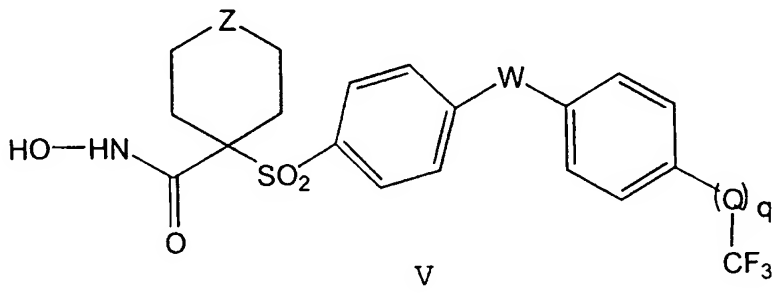
(wherein the R^3 radical is the substituent G-A-R-E-Y). Most preferably, R^3 is as defined in formula III.

Z is selected group the group consisting of O, S, NR^6, SO, SO_2, and NSO_2R^7,

wherein R^6 is selected from the group consisting of hydrido, C_1-C_5-alkyl, C_1-C_5-alkanoyl, benzyl, benzoyl, C_3-C_5-alkynyl, C_3-C_5-alkenyl, C_1-C_3-alkoxy-C_1-C_4-alkyl, C_3-C_6-cycloalkyl, heteroaryl-C_1-C_6-alkyl, C_1-C_5-hydroxyalkyl, C_1-C_5-carboxyalkyl, C_1-C_5-alkoxy C_1-C_5-alkylcarbonyl, and NR^8R^9-C_1-C_5-alkylcarbonyl or NR^8R^9-C_1-C_5-alkyl wherein R^8 and R^9 are independently hydrido, C_1-C_5-alkyl, C_1-C_5-alkoxycarbonyl or aryl-C_1-C_5-alkoxycarbonyl, or NR^8R^9 together form a heterocyclic ring containing 5- to 8-atoms in the ring; and

R^7 is selected from the group consisting of an arylalkyl, aryl, heteroaryl, heterocyclo, C_1-C_6-alkyl, C_3-C_6-alkynyl, C_3-C_6-alkenyl, C_1-C_6-carboxyalkyl and a C_1-C_6-hydroxyalkyl group. Most preferably, Z is O or NR^6. Here too, the use of a compound of formula IV as a pharmaceutically acceptable salt is contemplated.

A still more preferred group of contemplated compounds for use in a contemplated process correspond in structure to formula V, below;



V

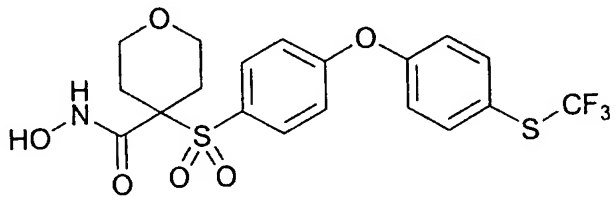
wherein

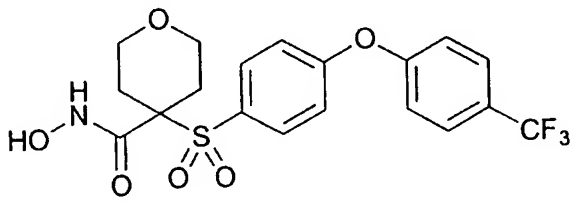
Z is as previously defined for formula IV;

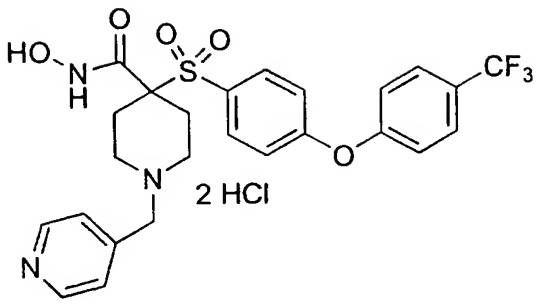
W and Q are independently oxygen (O), NR^6 or sulfur (S), and R^6 is as defined in formula IV; and

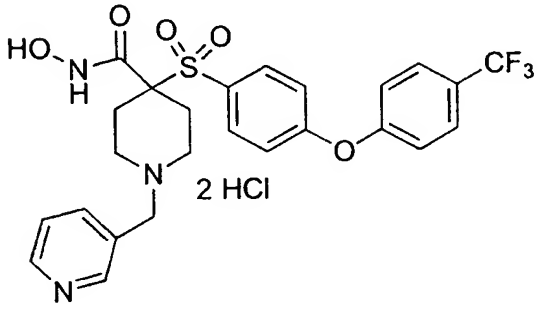
q is zero or one such that when q is zero, Q is absent and the trifluoromethyl group is bonded directly to the depicted phenyl ring. Here again, the use of a compound of formula IV as a pharmaceutically acceptable salt is contemplated.

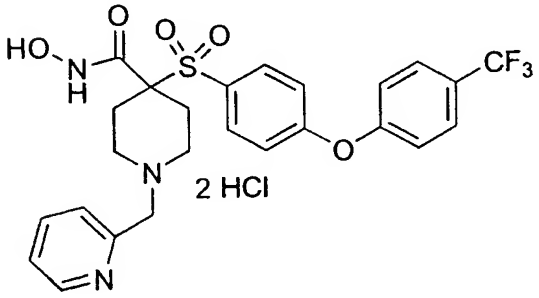
Particularly preferred compounds within the group defined by formula V have the structural formulas shown below:



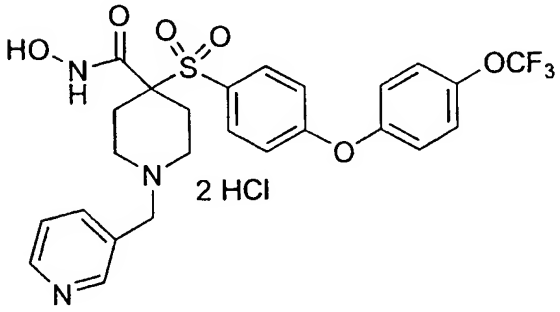


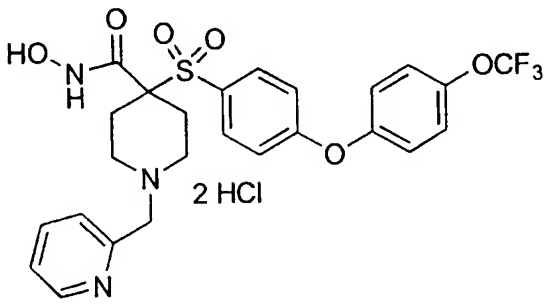

HO
N
H
O
O
S
O
CF3
O
N
2 HCl
N

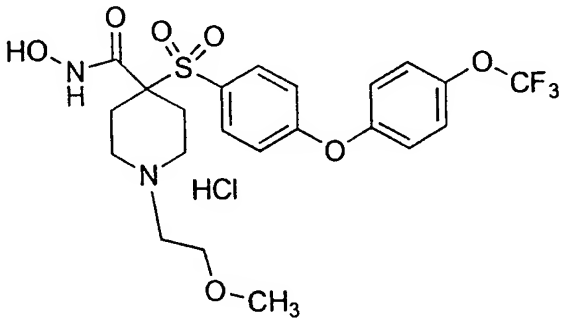

HO
N
H
O
O
S
O
CF3
O
N
2 HCl
N


HO
N
H
O
O
S
O
CF3
O
N
2 HCl
N

5


HO
N
H
O
O
S
O
OCF3
O
N
2 HCl
N


HO
N
H
O
O
O
S
OCF3
O
N
2 HCl
N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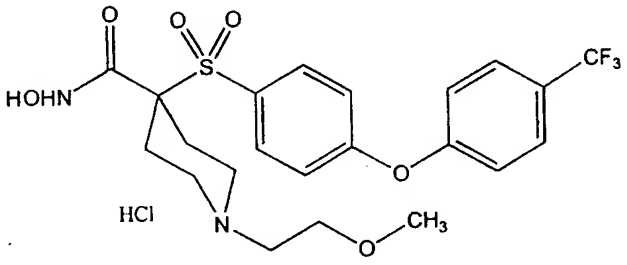
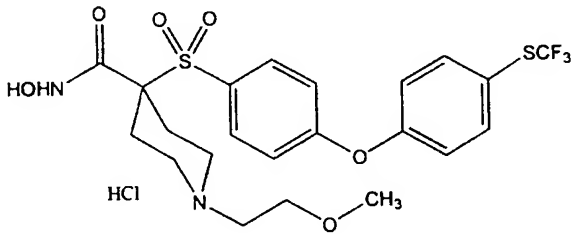
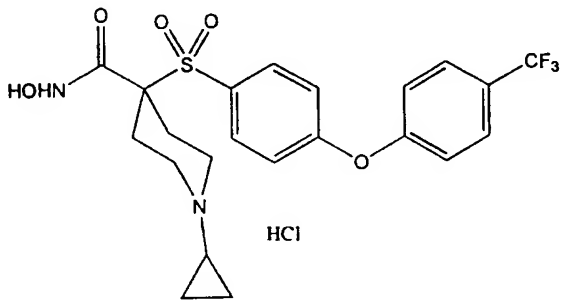
H
O
O
O
S
O
CF3
O
N
HCl
O
CH3

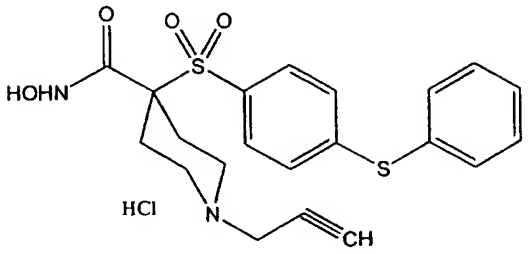
5

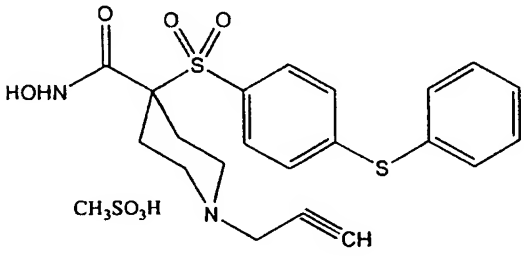

HOHN
O
O
O
S
CF3
O
HCl
N
O
CH3


HOHN
O
O
O
S
SCF3
O
HCl
N
O
CH3



Also particularly preferred are the following compounds:





Several particularly preferred compounds whose structures correspond to formulas I through V are illustrated in the Tables and examples provided hereinafter.

As was noted before, the compounds of formulas II, III, IV and V, and their pharmaceutically acceptable salts are themselves contemplated compounds of the invention.

In preferred practice, an SO_2-linked R^3 radical is an aryl or heteroaryl group that is a 5- or 6-membered single-ring that is itself substituted with one other single-ringed aryl or heteroaryl group or, with an alkyl or alkoxy group having a chain length of 3 to about 16 carbon atoms (and more preferably a length of up to about 14 carbon atoms), a phenoxy group, a thiophenoxy [C_6H_5-S-] group, a phenylazo [C_6H_5-N_2-] group, a N-piperidyl [$C_5H_{10}N$-] group, a N-piperazyl [NC_4H_9N-] group or a benzamido [-NHC(O)C_6H_5] group. The SO_2-linked single-ringed aryl or heteroaryl R^3 group here is substituted at its own 4-position when a 6-membered ring and at its own 3- or 4-position when a 5-membered ring.

The SO_2-linked aryl or heteroaryl group of a R^3 radical is preferably itself substituted at the 4-position when a 6-membered ring or the 3- or 4-position when a 5-membered ring. A particularly preferred substituent is a single-ringed aryl or heteroaryl, phenoxy, thiophenoxy, phenylazo, N-piperidyl, N-piperazyl or benzamido group that is unsubstituted or can itself be substituted.

The 4- and 3-positions of rings discussed here are numbered from the sites of substituent bonding as compared to formalized ring numbering positions used in heteroaryl nomenclature, as is discussed further hereinbelow. Here, single atoms such as halogen moieties (fluoro, chloro, bromo, or iodo) or substituents that contain one to a chain length of about five atoms other than hydrogen such as phenyl, C_1-C_4 alkyl, trifluoromethyl,

trifluoromethoxy, trifluorothiomethyl or carboxyethyl groups are preferred, although longer substituents can be accommodated up to a total length of an icosyl group.

Exemplary particularly preferred substituted SO_2-linked R^3 radicals include 4-(phenyl)phenyl [biphenyl], 4-(4'-methoxyphenyl)-phenyl, 4-(phenoxy)phenyl, 4-(thiophenyl)phenyl [4-(phenylthio)phenyl], 4-(azophenyl)phenyl, 4-[(4'-trifluoromethylthio)phenoxy]phenyl, 4-[(4'-trifluoromethylthio)thiophenyl]phenyl, 4-[(4'-trifluoromethyl)phenoxy]phenyl, 4-[(4'-trifluoromethyl)thiophenyl]phenyl, 4-[(4'-trifluoromethoxy)phenoxy]phenyl, 4-[(4'-trifluoromethoxy)thiophenyl]phenyl, 4-[(4'-phenyl)N-piperidyl]phenyl, 4-[(4'-acetyl)N-piperazyl]phenyl and 4-(benzamido)phenyl.

Inasmuch as a contemplated SO_2-linked aryl or heteroaryl radical of an R^3 group is itself preferably substituted with a 6-membered ring, two nomenclature systems are used together herein for ease in understanding substituent positions. The first system uses position numbers for the ring directly bonded to the SO_2-group, whereas the second system uses ortho, meta or para for the position of one or more substituents of a 6-membered ring bonded to a SO_2-linked aryl or heteroaryl radical. Although ortho, meta and para positional nomenclature is normally not used with aliphatic ring systems, it is believed more readily understood for describing the present compounds when used in conjunction with the numerical system for the first ring bonded to the

SO_2-group. When a R^3 radical is other than a 6-membered ring, substituent positions are numbered from the position of linkage to the aromatic or heteroaromatic ring. Formal chemical nomenclature is used in naming particular compounds.

Thus, the 1-position of an above-discussed SO_2-linked aryl or heteroaryl group is the position at which the SO_2-group is bonded to the ring. The 4- and 3-positions of rings discussed here are numbered from the sites of substituent bonding from the SO_2-linkage as compared to formalized ring numbering positions used in heteroaryl nomenclature.

When examined along its longest chain of atoms, an R^3 radical including its own substituent has a total length that is greater than a saturated chain of five carbon atoms (a pentyl group), and preferably has a length greater than that of a saturated chain of six carbon atoms (a hexyl group); i.e., a length of about a heptyl chain or longer. An R^3 radical also has a length that is less than that of a saturated chain of about 20 carbon atoms [an icosyl group (icosyl was formerly spelled eicosyl)] and more preferably about 18 carbon atoms (a stearyl group). Most preferably, the length of R^3 is about that of an 8 to about 12 carbon atom chain, even though many more atoms may be present in ring structures or substituents. This length requirement is discussed further below.

Looked at more generally, and aside from specific moieties from which it is constructed, an R^3 radical (group or moiety) has a length that is

greater than that of a pentyl group. Such an R^3 radical also has a length that is less than that of an icosyl (didecyl) group. That is to say that R^3 is a radical having a minimal length longer that a saturated five carbon chain, and preferably greater than a hexyl group, but is shorter than the length of a saturated twenty carbon atom chain, and preferably shorter than an eighteen carbon chain. Most preferably, R^3 has a length greater than that of an octyl group and less than that of a lauryl group.

More specifically, an R^3 group has a minimal length of a hexyl group only when that substituent is comprised of two rings that can be fused or simply covalently linked together by exocyclic bonding. When R^3 does not contain two linked or fused rings, e.g., where a R^3 radical includes an alkyl or second, third or fourth ring substituent, R^3 has a length that is greater than that of a hexyl group. Exemplary of such two ring R^3 groups are a 2-naphthyl group or a 2-quinolinyl group (each with a six carbon chain length) and 8-purinyl (with a five carbon atom chain length). Without wishing to be bound by theory, it is believed that the presence of multiple rings in R^3 enhances selectivity of the enzyme activity inhibitor profile.

The radical chain lengths are measured along the longest linear atom chain in the radical, following the skeletal atoms around a ring where necessary. Each atom in the chain, e.g. carbon, oxygen, sulfur or nitrogen, is presumed to be carbon for ease in calculation.

Such lengths can be readily determined by using published bond angles, bond lengths and atomic radii, as needed, to draw and measure a desired, usually staggered, chain, or by building models using commercially available kits whose bond angles, lengths and atomic radii are in accord with accepted, published values. Radical (substituent) lengths can also be determined somewhat less exactly by assuming that all atoms have bond lengths saturated carbon, that unsaturated bonds have the same lengths as saturated bonds and that bond angles for unsaturated bonds are the same as those for saturated bonds, although the above-mentioned modes of measurement are preferred. For example, a phenyl or pyridyl group has a length of a four carbon chain, as does a propoxy group, whereas a biphenyl group has a length of about an eight carbon chain using such a measurement mode.

In addition, a R^3 group when rotated about an axis drawn through the SO_2-bonded 1-position and the 4-position of a 6-membered ring or the SO_2-bonded position and substituent-bonded 3- or 4-position of a 5-membered ring defines a three-dimensional volume whose widest dimension has the width of about one furanyl ring to about two phenyl rings in a direction transverse to that axis to rotation.

Thus, a 2-naphthyl substituent or an 8-purinyl substituent is an appropriately sized R^3 group when examined using the above rotational width criterion as well as the before-discussed criterion. On the other hand, a 1-naphthyl group or a 7- or 9-

purinyl group is too wide upon rotation and is excluded from being an R^3 group.

As a consequence of these length and width requirements, R^3 radicals such as 4-(phenyl)phenyl [biphenyl], 4-(4'-methoxyphenyl)-phenyl, 4-(phenoxy)phenyl, 4-(thiophenyl)phenyl [4-(phenylthio)phenyl], 4-(azophenyl)phenyl, 4-[(4'-trifluoromethylthio)phenoxy]phenyl, 4-[(4'-trifluoromethylthio)thiophenyl]phenyl, 4-[(4'-trifluoromethyl)phenoxy]phenyl, 4-[(4'-trifluoromethyl)thiophenyl]phenyl, 4-[(4'-trifluoromethoxy)phenoxy]phenyl, 4-[(4'-trifluoromethoxy)thiophenyl]phenyl, 4-[(4'-phenyl)N-piperidyl]phenyl, 4-[(4'-acetyl)N-piperazyl]phenyl and 4-(benzamido)phenyl are particularly preferred R^3 radicals. Those substituents can themselves also be substituted in the second ring from the SO_2 group at the meta- or para-position or both with a single atom or a substituent containing a longest chain length that is preferably of up to five atoms, excluding hydrogen.

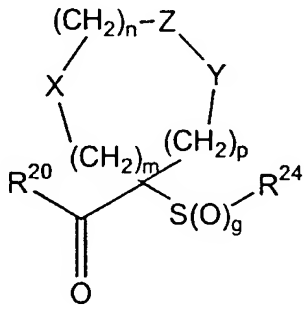
Without wishing to be bound by theory, the length of a R^3 radical substituent bonded to the SO_2 group is believed to play a role in the overall activity of a contemplated inhibitor compound against MMP enzymes generally. The length of the R^3 radical group also appears to play a role in the selective activity of an inhibitor compound against particular MMP enzymes.

In particularly preferred practice, R^3 is a PhR^{23} group, wherein Ph is phenyl. The phenyl ring

(Ph) of a PhR^{23} group is substituted at its para-position (4-position) by an R^{23} group that can be another single-ringed aryl or heteroaryl group, a piperidyl group, a piperazinyl group, a phenoxy group, a thiophenoxy [C_6H_5-S-] group, a phenylazo [C_6H_5-N_2-] group or a benzamido [-NHC(O)C_6H_5] group.

In one embodiment of a particularly preferred aromatic sulfone hydroxamate inhibitor compound, an R^{23} substituent is phenoxy and is itself substituted at its own para-position with a moiety that is selected from the group consisting of a halogen, a C_1-C_4 alkoxy group, a C_1-C_4 alkyl group, a dimethylamino group, a carboxyl C_1-C_3 alkylene group, a C_1-C_4 alkoxy carbonyl C_1-C_3 alkylene group, a trifluoromethylthio group, a trifluoromethoxy group, a trifluoromethyl group and a carboxamido C_1-C_3 alkylene group, or is substituted at the meta- and para-positions by a methylenedioxy group. It is to be understood that any R^{23} substituent can be substituted with a moiety from the above list. Such substitution at the para-position is preferred.

The present invention also contemplates an intermediate compound that is useful in preparing a compound of formulas I-V. Such an intermediate compound corresponds in structure to formula VI, below:



VI

wherein g is zero, 1 or 2;

R^{20} is (a) -O-R^{21}, where R^{21} is selected from the group consisting of a hydrido, C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl group and a pharmaceutically acceptable cation, or (b) -NH-O-R^{22} wherein R^{22} is a selectively removable protecting group such as a 2-tetrahydropyranyl, C_1-C_6-acyl, aroyl, benzyl, p-methoxybenzyl (MOZ) carbonyl-C_1-C_6-alkoxy, trisubstituted silyl group or o-nitrophenyl group, peptide systhesis resin and the like, wherein trisubstituted silyl group is substituted with C_1-C_6-alkyl, aryl, or ar-C_1-C_6-alkyl;

m is zero, 1 or 2;

n is zero, 1 or 2;

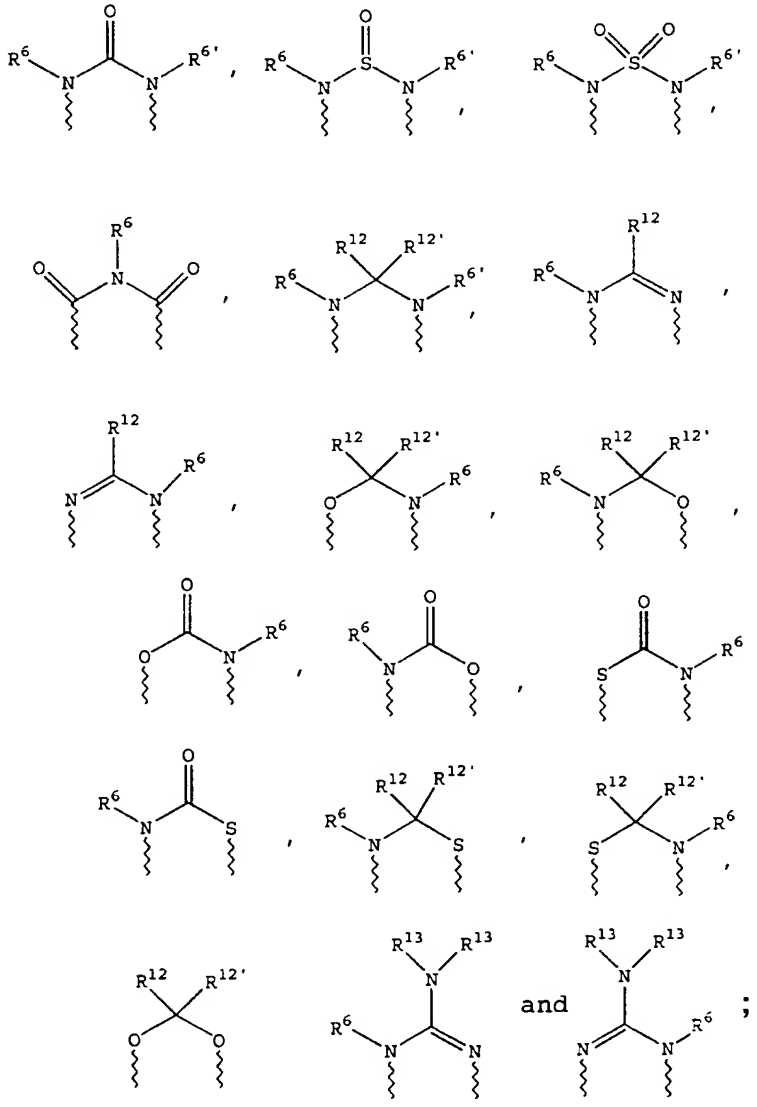
p is zero, 1 or 2;

the sum of m + n + p = 1, 2, 3 or 4;

(a) one of X, Y and Z is selected from the group consisting of C(O), NR^6, O, S, S(O), $S(O)_2$ and $NS(O)_2R^7$, and the remaining two of X, Y and Z are CR^8R^9, and $CR^{10}R^{11}$, or

(b) X and Z or Z and Y together constitute a moiety that is selected from the group consisting of $NR^6C(O)$, $NR^6S(O)$, $NR^6S(O)_2$, NR^6S, NR^6O, SS, NR^6NR^6 and OC(O), with the remaining one of X, Y and Z being CR^8R^9, or

(c) n is zero and X, Y and Z together constitute a moiety selected from the group consisting of



and ;

wherein wavy lines are bonds to the atoms of the depicted ring;

R^6 and $R^{6'}$ are independently selected from the group consisting of hydrido, C_1-C_6-alkanoyl, C_6-aryl-C_1-C_6-alkyl, aroyl, bis(C_1-C_6-alkoxy-C_1-C_6-alkyl)-C_1-C_6-alkyl, C_1-C_6-alkyl, C_1-C_6-haloalkyl, C_1-C_6-perfluoroalkyl, C_1-C_6-trifluoromethylalkyl, C_1-C_6-perfluoroalkoxy-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, C_3-C_6-cycloalkyl, C_3-C_8-heterocycloalkyl, C_3-C_8-heterocycloalkylcarbonyl, C_6-aryl, C_5-C_6-heterocyclo, C_5-C_6-heteroaryl, C_3-C_8-cycloalkyl-C_1-C_6-alkyl, C_6-aryloxy-C_1-C_6-alkyl, heteroaryloxy-C_1-C_6-alkyl, heteroaryl-C_1-C_6-alkoxy-C_1-C_6-alkyl, heteroarylthio-C_1-C_6-alkyl, C_6-arylsulfonyl, C_1-C_6-alkylsulfonyl, C_5-C_6-heteroarylsulfonyl, carboxy-C_1-C_6-alkyl, C_1-C_4-alkoxycarbonyl-C_1-C_6-alkyl, aminocarbonyl, C_1-C_6-alkyliminocarbonyl, C_6-aryliminocarbonyl, C_5-C_6-heterocycloiminocarbonyl, C_6-arylthio-C_1-C_6-alkyl, C_1-C_6-alkylthio-C_1-C_6-alkyl, C_6-arylthio-C_3-C_6-alkenyl, C_1-C_4-alkylthio-C_3-C_6-alkenyl, C_5-C_6-heteroaryl-C_1-C_6-alkyl, halo-C_1-C_6-alkanoyl, hydroxy-C_1-C_6-alkanoyl, thiol-C_1-C_6-alkanoyl, C_3-C_6-alkenyl, C_3-C_6-alkynyl, C_1-C_4-alkoxy-C_1-C_4-alkyl, C_1-C_5-alkoxycarbonyl, aryloxycarbonyl, NR^8R^9-C_1-C_5-alkylcarbonyl, hydroxy-C_1-C_5-alkyl, an aminocarbonyl wherein the aminocarbonyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group

consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group, hydroxyaminocarbonyl, an aminosulfonyl group wherein the aminosulfonyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group, an amino-C_1-C_6-alkylsulfonyl group wherein the amino-C_1-C_6-alkylsulfonyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group and an amino-C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, C_3-C_8-cycloalkyl and a C_1-C_6-alkanoyl group;

R^7 is selected from the group consisting of a benzyl, phenyl, C_1-C_6-alkyl, C_3-C_6-alkynyl, C_3-C_6-alkenyl and a C_1-C_6-hydroxyalkyl group;

R^8 and R^9 and R^{10} and R^{11} are independently selected from the group consisting of a hydrido, hydroxy, C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl, heteroaryl, heteroar-C_1-C_6-alkyl, C_2-C_6-alkynyl, C_2-C_6-alkenyl, thiol-C_1-C_6-alkyl, C_1-C_6-alkylthio-C_1-C_6-alkyl cycloalkyl, cycloalkyl-C_1-C_6-alkyl, heterocycloalkyl-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, aralkoxy-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-

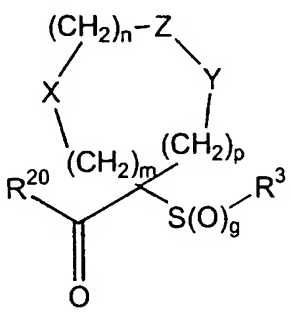
alkoxy-C_1-C_6-alkyl, hydroxy-C_1-C_6-alkyl, hydroxycarbonyl-C_1-C_6-alkyl, hydroxycarbonylar-C_1-C_6-alkyl, aminocarbonyl-C_1-C_6-alkyl, aryloxy-C_1-C_6-alkyl, heteroaryloxy-C_1-C_6-alkyl, arylthio-C_1-C_6-alkyl, heteroarylthio-C_1-C_6-alkyl, the sulfoxide or sulfone of any said thio substituents, perfluoro-C_1-C_6-alkyl, trifluoromethyl-C_1-C_6-alkyl, halo-C_1-C_6-alkyl, alkoxycarbonylamino-C_1-C_6-alkyl and an amino-C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, cycloalkyl and C_1-C_6-alkanoyl, or wherein R^8 and R^9 or R^{10} and R^{11} and the carbon to which they are bonded form a carbonyl group, or wherein R^8 and R^9 or R^{10} and R^{11}, or R^8 and R^{10} together with the atoms to which they are bonded form a 5- to 8-membered carbocyclic ring, or a 5- to 8-membered heterocyclic ring containing one or two heteroatoms that are nitrogen, oxygen, or sulfur, with the proviso that only one of R^8 and R^9 or R^{10} and R^{11} is hydroxy;

R^{12} and $R^{12'}$ are independently selected from the group consisting of a hydrido, C_1-C_6-alkyl, aryl, ar-C_1-C_6-alkyl, heteroaryl, heteroaralkyl, C_2-C_6-alkynyl, C_2-C_6-alkenyl, thiol-C_1-C_6-alkyl, cycloalkyl, cycloalkyl-C_1-C_6-alkyl, heterocycloalkyl-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkyl, aryloxy-C_1-C_6-alkyl, amino-C_1-C_6-alkyl, C_1-C_6-alkoxy-C_1-C_6-alkoxy-

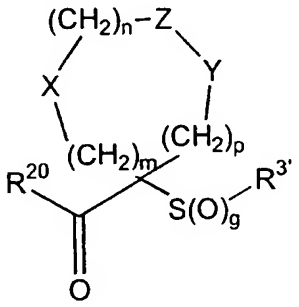
C_1-C_6-alkyl, hydroxy-C_1-C_6-alkyl, hydroxycarbonyl-C_1-C_6-alkyl, hydroxycarbonylar-C_1-C_6-alkyl, aminocarbonyl-C_1-C_6-alkyl, aryloxy-C_1-C_6-alkyl, heteroaryloxy-C_1-C_6-alkyl, C_1-C_6-alkylthio-C_1-C_6-alkyl, arylthio-C_1-C_6-alkyl, heteroarylthio-C_1-C_6-alkyl, the sulfoxide or sulfone of any said thio substituents, perfluoro-C_1-C_6-alkyl, trifluoromethyl-C_1-C_6-alkyl, halo-C_1-C_6-alkyl, alkoxycarbonylamino-C_1-C_6-alkyl and an amino-C_1-C_6-alkyl group wherein the aminoalkyl nitrogen is (i) unsubstituted or (ii) substituted with one or two radicals independently selected from the group consisting of C_1-C_6-alkyl, ar-C_1-C_6-alkyl, cycloalkyl and C_1-C_6-alkanoyl;

R^{13} is selected from the group consisting of a hydrido, benzyl, phenyl, C_1-C_6-alkyl, C_2-C_6-alkynyl, C_2-C_6-alkenyl and a C_1-C_6-hydroxyalkyl group; and

R^{24} is R^3 as defined in formulas I, III, IV or is the substituent G-A-R-E-Y of formula II (formula VIA). Alternatively, R^{24} is $R^{3'}$, an aryl or heteroaryl group that is substituted with a coupling substituent reactive for coupling with another moiety (formula VIB), such as a nucleophilically displaceable leaving group, D.



VIA



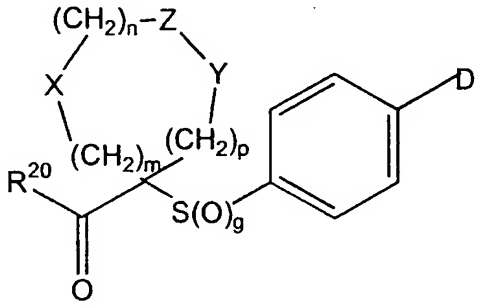
VIB

Exemplary nucleophilically displaceable leaving groups, D, include a halo (fluoro, chloro, bromo, or idodo) nitro, azido, phenylsulfoxido, aryloxy, C_1-C_6-alkoxy, a C_1-C_6-alkylsulfonate or arylsulfonate group and a trisubstituted ammonium group in which the three substituents are independently aryl, ar- C_1-C_6-alkyl or C_1-C_6-alkyl. Additional coupling substituents include, without limitation, a hydroxyl group and an amino group that can be coupled with carbonyl-containing moieties to form esters, urethanes, carbonates, amides and ureas. Similarly, a carboxyl coupling substituent can be used to form an ester, thioester or amide. Thus, a coupling substituent is useful in converting a coupling substituent-containing aryl or heteroaryl group into a substituent such as a G-A-R-E-Y substituent discussed hereinabove by the formation of a covalent bond.

A compound of formula VI can be coupled with another moiety at the $R^{3'}$ coupling substituent to form a compound whose newly formed R^3 group is that of formulas I, III, IV or -G-A-R-E-Y. Exemplary of such couplings are the nucleophilic displacement to form ethers and thioethers, as well as the formation

of ester, amide, urea, carbonate, urethane and the like linkages.

A particularly preferred precursor intermediate to an intermediate compound of formula VI is an intermediate compound of formula VII, below



VII

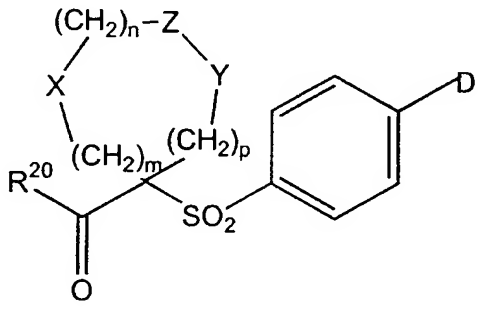
wherein m, n, p, g, X, Z, Y, D and R^{20} are as defined above for formula VI.

R^{20} is preferably -NH-O-R^{22}, wherein R^{22} is a selectively removable protecting group such as a 2-tetrahydropyranyl, C_1-C_6-acyl, aroyl, benzyl, p-methoxybenzyl (MOZ) carbonyl-C_1-C_6-alkoxy, o-nitrophenyl group, a peptide syntheisi resin such as a so-called Merrifield's Peptide Resin commercially available from Sigma Chemical Co., and the like, with 2-tetrahydropyranyl being particularly preferred. An -NH-O-R^{22} group (R^{20}) in formulas VI and VII is therefore seen to be a reaction product of a hydroxyl amine whose oxygen is bonded to a selectively removable protecting group and a carboxyl group.

In regard to a compound of each of formulas VI and VII, the subscript letter "g" is used to show the oxidation state of the sulfur atom. Where g is zero,

the sulfur is unoxidized, and the compound depicted is typically the sulfide reaction product of a sulfur-containing synthon as is illustrated in the examples hereinafter. Where g is 1, the sulfur is oxidized to a sulfoxide, whereas when g is 2, the sulfur is oxidized to a sulfone as is also illustrated hereinafter. A compound of formulas VI or VII wherein g is zero or 1 are themselves typically intermediates in the formation of a similar compound wherein g is 2 and the intermediate is a preferred sulfone.

A preferred intermediate therefore corresponds in structure to formula VIIA, below



VIIA

In the written descriptions of molecules and groups, molecular descriptors can be combined to produce words or phrases that describe structural groups or are combined to describe structural groups. Such descriptors are used in this document. Common illustrative examples include such terms as aralkyl (or arylalkyl), heteroaralkyl, heterocycloalkyl, cycloalkylalkyl, aralkoxyalkoxycarbonyl and the like. A specific example of a compound encompassed with the latter descriptor aralkoxyalkoxycarbonyl is C_6H_5-CH_2-

CH_2-O-CH_2-O-(C=O)- wherein C_6H_5- is phenyl. It is also to be noted that a structural group can have more than one descriptive word or phrase in the art, for example, heteroaryloxyalkylcarbonyl can also be termed heteroaryloxyalkanoyl. Such combinations are used herein in the description of the processes, compounds and compositions of this invention and further examples are described below. The following list is not intended to be exhaustive or drawn out but provide illustrative examples of words or phrases (terms) that are used herein.

As utilized herein, the term "alkyl", alone or in combination, means a straight-chain or branched-chain alkyl radical containing 1 to about 12 carbon atoms, preferably 1 to about 10 carbon atoms, and more preferably 1 to about 6 carbon atoms. Examples of such radicals include methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, pentyl, iso-amyl, hexyl, octyl and the like.

The term "alkenyl", alone or in combination, means a straight-chain or branched-chain hydrocarbon radical having one or more double bonds and containing 2 to about 12 carbon atoms preferably 2 to about 10 carbon atoms, and more preferably, 2 to about 6 carbon atoms. Examples of suitable alkenyl radicals include ethenyl (vinyl), 2-propenyl, 3-propenyl, 1,4-pentadienyl, 1,4-butadienyl, 1-butenyl, 2-butenyl, 3-butenyl, decenyl and the like.

The term "alkynyl", alone or in combination, means a straight-chain hydrocarbon radical having one or more triple bonds and containing 2 to about 12 carbon atoms, preferably 2

to about 10 carbon atoms, and more preferably, 2 to about 6 carbon atoms. Examples of alkynyl radicals include ethynyl, 2-propynyl, 3-propynyl, decynyl, 1-butynyl, 2-butynyl, 3-butynyl, and the like.

The term "carbonyl" or "oxo", alone or in combination, means a -C(=O)- group wherein the remaining two bonds (valences) can be independently substituted. The term carbonyl is also intended to encompass a hydrated carbonyl group $-C(OH)_2-$.

The term "thiol" or "sulfhydryl", alone or in combination, means a -SH group. The term "thio" or "thia", alone or in combination, means a thiaether group; i.e., an ether group wherein the ether oxygen is replaced by a sulfur atom.

The term "amino", alone or in combination, means an amine or $-NH_2$ group whereas the term mono-substituted amino, alone or in combination, means a substituted amine -N(H)(substituent) group wherein one hydrogen atom is replaced with a substituent, and disubstituted amine means a $-N(substituent)_2$ wherein two hydrogen atoms of the amino group are replaced with independently selected substituent groups.

Amines, amino groups and amides are compounds that can be designated as primary (I°), secondary (II°) or tertiary (III°) or unsubstituted, mono-substituted or N,N-disubstituted depending on the degree of substitution of the amino nitrogen. Quaternary amine (ammonium)(IV°) means a nitrogen with four substituents $[-N^+(substituent)_4]$ that is positively charged and accompanied by a counter ion, whereas N-oxide means one substituent is oxygen and

the group is represented as [-N^+(substituent)$_3$-O^-]; i.e., the charges are internally compensated.

The term "cyano", alone or in combination, means a -C-triple bond-N (-C≡N) group. The term "azido", alone or in combination, means a -N-triple bond-N (-N≡N) group. The term "hydroxyl", alone or in combination, means a -OH group. The term "nitro", alone or in combination, means a -NO_2 group. The term "azo", alone or in combination, means a -N=N- group wherein the bonds at the terminal positions can be independently substituted.

The term "hydrazino", alone or in combination, means a -NH-NH- group wherein the depicted remaining two bonds (valences) can be independently substituted. The hydrogen atoms of the hydrazino group can be replaced, independently, with substituents and the nitrogen atoms can form acid addition salts or be quaternized.

The term "sulfonyl", alone or in combination, means a -SO_2- group wherein the depicted remaining two bonds (valences) can be independently substituted. The term "sulfoxido", alone or in combination, means a -SO- group wherein the remaining two bonds (valences) can be independently substituted.

The term "sulfone", alone or in combination, means a -SO_2- group wherein the depicted remaining two bonds (valences) can be independently substituted. The term "sulfenamide", alone or in combination, means a -SON= group wherein the remaining three depicted bonds (valences) can be independently substituted. The term "sulfide", alone

or in combination, means a -S- group wherein the remaining two bonds (valences) can be independently substituted.

The term "alkoxy", alone or in combination, means an alkyl ether radical wherein the term alkyl is as defined above. Examples of suitable alkyl ether radicals include methoxy, ethoxy, n-propoxy, isopropoxy, n-butoxy, iso-butoxy, sec-butoxy, tert-butoxy and the like.

The term "cycloalkyl", alone or in combination, means a cyclic alkyl radical that contains 3 to about 8 carbon atoms. The term "cycloalkylalkyl" means an alkyl radical as defined above that is substituted by a cycloalkyl radical containing 3 to about 8, preferably 3 to about 6, carbon atoms. Examples of such cycloalkyl radicals include cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl and the like.

A heterocyclic (heterocyclo) or heterocyclo portion of a heterocyclocarbonyl, heterocyclooxy-carbonyl, heterocycloalkoxycarbonyl, or heterocycloalkyl group or the like is a saturated or partially unsaturated monocyclic, bicyclic or tricyclic heterocycle that contains one or more hetero atoms selected from nitrogen, oxygen and sulphur. Such a moiety can be optionally substituted on one or more ring carbon atoms by halogen, alkyl, alkoxy, oxo, and the like, and/or on a secondary nitrogen atom (i.e., -NH-) of the ring by alkyl, aralkoxycarbonyl, alkanoyl, aryl or arylalkyl or on a tertiary nitrogen atom (i.e., =N-) by oxido and that is attached via a carbon atom. The tertiary nitrogen

atom with three substituents can also attached to form a N-oxide [=N(O)-] group.

The term "aryl", alone or in combination, means a 5- or 6-membered carbocyclic aromatic ring-containing moiety or a fused ring system containing two or three rings that have all carbon atoms in the ring; i.e., a carbocyclic aryl radical. Exemplary carbocyclic aryl radicals include phenyl, indenyl and naphthyl radicals.

The term "heteroaryl", alone or in combination means a 5- or 6-membered aromatic ring-containing moiety or a fused ring system (radical) containing two or three rings that have carbon atoms and also one or more heteroatoms in the ring(s) such as sulfur, oxygen and nitrogen. Examples of such heterocyclic or heteroaryl groups are pyrrolidinyl, piperidyl, piperazinyl, morpholinyl, thiamorpholinyl, pyrrolyl, imidazolyl (e.g., imidazol-4-yl, 1-benzyloxycarbonylimidazol-4-yl, and the like), pyrazolyl, pyridyl, pyrazinyl, pyrimidinyl, furyl, tetrahydrofuryl, thienyl, triazolyl, oxazolyl, oxadiazoyl, thiazolyl, thiadiazoyl, indolyl (e.g., 2-indolyl, and the like), quinolinyl, (e.g., 2-quinolinyl, 3-quinolinyl, 1-oxido-2-quinolinyl, and the like), isoquinolinyl (e.g., 1-isoquinolinyl, 3-isoquinolinyl, and the like), tetrahydroquinolinyl (e.g., 1,2,3,4-tetrahydro-2-quinolyl, and the like), 1,2,3,4-tetrahydroisoquinolinyl (e.g., 1,2,3,4-tetrahydro-1-oxo-isoquinolinyl, and the like), quinoxalinyl, β-carbolinyl, 2-benzofurancarbonyl, benzothiophenyl, 1-, 2-, 4- or 5-benzimidazolyl, and the like radicals.

When an aryl or heteroaryl radical is a substituting moiety (group, substituent, or radical), it can itself substituted, the last-named substituent is independently selected from the group consisting of a cyano, perfluoroalkyl, trifluoro-methoxy, trifluoromethylthio, haloalkyl, trifluoromethylalkyl, aralkoxycarbonyl, aryloxycarbonyl, hydroxy, halo, alkyl, alkoxy, nitro, thiol, hydroxycarbonyl, aryloxy, arylthio, aralkyl, aryl, arylcarbonylamino, heteroaryloxy, heteroarylthio, heteroaralkyl, cycloalkyl, heterocyclooxy, heterocyclothio, heterocycloamino, cycloalkyloxy, cycloalkylthio, heteroaralkoxy, heteroaralkylthio, aralkoxy, aralkylthio, aralkylamino, heterocyclo, heteroaryl, arylazo, hydroxycarbonylalkoxy, alkoxycarbonylalkoxy, alkanoyl, arylcarbonyl, aralkanoyl, alkanoyloxy, aralkanoyloxy, hydroxyalkyl, hydroxyalkoxy, alkylthio, alkoxyalkylthio, alkoxycarbonyl, aryloxyalkoxyaryl, arylthioalkylthioaryl, aryloxyalkylthioaryl, arylthioalkoxyaryl, hydroxycarbonylalkoxy, hydroxycarbonylalkylthio, alkoxycarbonylalkoxy, alkoxycarbonylalkylthio, amino, wherein the amino nitrogen is (i) unsubstituted, or (ii) substituted with one or two substituents that are independently selected from the group consisting of an alkyl, aryl, heteroaryl, aralkyl, cycloalkyl, aralkoxycarbonyl, alkoxycarbonyl, arylcarbonyl, aralkanoyl, heteroarylcarbonyl, heteroaralkanoyl and an alkanoyl group, or (iii) wherein the amino nitrogen and two substituents attached thereto form a 5- to 8-membered heterocyclo or

heteroaryl ring containing zero to two additional heteroatoms that are nitrogen, oxygen or sulfur and which ring itself is (a) unsubstituted or (b) substituted with one or two groups independently selected from the group consisting of an aryl, alkyl, heteroaryl, aralkyl, heteroaralkyl, hydroxy, alkoxy, alkanoyl, cycloalkyl, heterocycloalkyl, alkoxycarbonyl, hydroxyalkyl, trifluoromethyl, benzofused heterocycloalkyl, hydroxyalkoxyalkyl, aralkoxycarbonyl, hydroxycarbonyl, aryloxycarbonyl, benzofused heterocycloalkoxy, benzofused cycloalkylcarbonyl, heterocyclo-alkylcarbonyl, and a cycloalkylcarbonyl group,

carbonylamino

wherein the carbonylamino nitrogen is (i) unsubstituted, or (ii) is the reacted amine of an amino acid, or (iii) substituted with one or two radicals selected from the group consisting of an alkyl, hydroxyalkyl, hydroxyheteroaralkyl, cycloalkyl, aralkyl, trifluoromethylalkyl, heterocycloalkyl, benzofused heterocycloalkyl, benzofused heterocycloalkyl, benzofused cycloalkyl, and an N,N-dialkylsubstituted alkylamino-alkyl group, or (iv) the carboxamido nitrogen and two substituents bonded thereto together form a 5- to 8-membered heterocyclo, heteroaryl or benzofused heterocycloalkyl ring that is itself unsubstituted or substituted with one or two radicals independently selected from the group consisting of an alkyl, alkoxycarbonyl, nitro, heterocycloalkyl,

hydroxy, hydroxycarbonyl, aryl, aralkyl, heteroaralkyl and an amino group,

wherein the amino nitrogen is (i) unsubstituted, or (ii) substituted with one or two substituents that are independently selected from the group consisting of alkyl, aryl, and heteroaryl, or (iii) wherein the amino nitrogen and two substituents attached thereto form a 5- to 8-membered heterocyclo or heteroaryl ring,

and an aminoalkyl group

wherein the aminoalkyl nitrogen is (i) unsubstituted, or (ii) substituted with one or two substituents independently selected from the group consisting of an alkyl, aryl, aralkyl, cycloalkyl, aralkoxycarbonyl, alkoxycarbonyl, and an alkanoyl group, or (iii) wherein the aminoalkyl nitrogen and two substituents attached thereto form a 5- to 8-membered heterocyclo or heteroaryl ring.

The term "aralkyl", alone or in combination, means an alkyl radical as defined above in which one hydrogen atom is replaced by an aryl radical as defined above, such as benzyl, 2-phenylethyl and the like.

The term "aralkoxycarbonyl", alone or in combination, means a radical of the formula aralkyl-O-C(O)- in which the term "aralkyl" has the significance given above. An example of an aralkoxycarbonyl radical is benzyloxycarbonyl.

The term "aryloxy" means a radical of the formula aryl-O- in which the term aryl has the

significance given above. The phenoxy radical is an exemplary aryloxy radical.

The terms "heteroaralkyl" and "heteroaryloxy" mean radicals structurally similar to aralkyl and aryloxy that are formed from heteroaryl radicals. Exemplary radicals include 4-picolinyl and 2-pyrimidinoxy, respectively.

The terms "alkanoyl" or "alkylcarbonyl", alone or in combination, means an acyl radical derived from an alkanecarboxylic acid, examples of which include formyl, acetyl, propionyl, butyryl, valeryl, 4-methylvaleryl, and the like.

The term "cycloalkylcarbonyl" means an acyl group derived from a monocyclic or bridged cycloalkanecarboxylic acid such as cyclopropanecarbonyl, cyclohexanecarbonyl, adamantanecarbonyl, and the like, or from a benz-fused monocyclic cycloalkanecarboxylic acid that is optionally substituted by, for example, alkanoylamino, such as 1,2,3,4-tetrahydro-2-naphthoyl, 2-acetamido-1,2,3,4-tetrahydro-2-naphthoyl.

The terms "aralkanoyl" or "aralkylcarbonyl" mean an acyl radical derived from an aryl-substituted alkanecarboxylic acid such as phenylacetyl, 3-phenylpropionyl (hydrocinnamoyl), 4-phenylbutyryl, (2-naphthyl)acetyl, 4-chlorohydrocinnamoyl, 4-aminohydrocinnamoyl, 4-methoxyhydrocinnamoyl and the like.

The terms "aroyl" or "arylcarbonyl" means an acyl radical derived from an aromatic carboxylic acid. Examples of such radicals include aromatic carboxylic acids, an optionally substituted benzoic

or naphthoic acid such as benzoyl, 4-chlorobenzoyl, 4-carboxybenzoyl, 4-(benzyloxycarbonyl)benzoyl, 1-naphthoyl, 2-naphthoyl, 6-carboxy-2 naphthoyl, 6-(benzyloxycarbonyl)-2-naphthoyl, 3-benzyloxy-2-naphthoyl, 3-hydroxy-2-naphthoyl, 3-(benzyloxyformamido)-2-naphthoyl, and the like.

The term "cycloalkylalkoxycarbonyl" means an acyl group of the formula cycloalkylalkyl-O-CO- wherein cycloalkylalkyl has the significance given above. The term "aryloxyalkanoyl" means an acyl radical of the formula aryl-O-alkanoyl wherein aryl and alkanoyl have the significance given above. The term "heterocyclooxycarbonyl" means an acyl group having the formula heterocyclo-O-CO- wherein heterocyclo is as defined above.

The term "heterocycloalkanoyl" is an acyl radical of the formula heterocyclo-substituted alkane carboxylic acid wherein heterocyclo has the significance given above. The term "heterocycloalkoxycarbonyl" means an acyl radical of the formula heterocyclo-substituted alkane-O-CO- wherein heterocyclo has the significance given above. The term "heteroaryloxycarbonyl" means an acyl radical represented by the formula heteroaryl-O-CO- wherein heteroaryl has the significance given above.

The term "aminocarbonyl" (carboxamide) alone or in combination, means an amino-substituted carbonyl (carbamoyl) group derived from an amine reacted with a carboxylic acid wherein the amino (amido nitrogen) group is unsubstituted ($-NH_2$) or a substituted primary or secondary amino group containing one or two substituents selected from the group consisting of hydrogen, alkyl, aryl, aralkyl,

cycloalkyl, cycloalkylalkyl radicals and the like, as recited. A hydroxamate is a N-hydroxycarboxamide.

The term "aminoalkanoyl" means an acyl group derived from an amino-substituted alkanecarboxylic acid wherein the amino group can be a primary or secondary amino group containing substituents independently selected from hydrogen, alkyl, aryl, aralkyl, cycloalkyl, cycloalkylalkyl radicals and the like.

The term "halogen" means fluoride, chloride, bromide or iodide. The term "haloalkyl" means an alkyl radical having the significance as defined above wherein one or more hydrogens are replaced with a halogen. Examples of such haloalkyl radicals include chloromethyl, 1-bromoethyl, fluoromethyl, difluoromethyl, trifluoromethyl, 1,1,1-trifluoroethyl and the like.

The term "perfluoroalkyl" means an alkyl group wherein each hydrogen has been replaced by a fluorine atom. Examples of such perfluoroalkyl groups, in addition to trifluoromethyl above, are perfluorobutyl, perfluoroisopropyl, perfluorododecyl and perfluorodecyl.

The term "perfluoroalkoxy" alone or in combination, means a perfluoroalkyl ether radical wherein the term perfluoroalkyl is as defined above. Examples of such perfluoroalkoxy groups, in addition to trifluoromethoxy (F_3C-O-), are perfluorobutoxy, perfluoroisopropoxy, perfluorododecoxy and perfluorodecoxy.

The term "perfluoroalkylthio" alone or in combination, means a perfluoroalkyl thioether radical wherein the term perfluoroalkyl is as defined above.

Examples of such perfluoroalkylthio groups, in addition to trifluoromethylthio (F_3C-S-), are perfluorobutylthio, perfluoroisopropylthio, perfluorododecylthio and perfluorodecylthio.

The term "aromatic ring" in combinations such as substituted-aromatic ring sulfone or substituted-aromatic ring sulfoxide means aryl or heteroaryl as defined before.

The term "pharmaceutically acceptable" is used adjectivally herein to mean that the modified noun is appropriate for use in a pharmaceutical product. Pharmaceutically acceptable cations include metallic ions and organic ions. More preferred metallic ions include, but are not limited to appropriate alkali metal (Group Ia) salts, alkaline earth metal (Group IIa) salts and other physiological acceptable metal ions. Exemplary ions include aluminum, calcium, lithium, magnesium, potassium, sodium and zinc in their usual valences. Preferred organic ions include protonated tertiary amines and quaternary ammonium cations, including in part, trimethylamine, diethylamine, N,N'-dibenzylethylenediamine, chloroprocaine, choline, diethanolamine, ethylenediamine, meglumine (N-methylglucamine) and procaine. Exemplary pharmaceutically acceptable acids include without limitation hydrochloric acid, hydrobromic acid, phosphoric acid, sulfuric acid, methanesulfonic acid, acetic acid, formic acid, tartaric acid, maleic acid, malic acid, citric acid, isocitric acid, succinic acid, lactic acid, gluconic acid, glucuronic acid,

pyruvic acid oxalacetic acid, fumaric acid, propionic acid, aspartic acid, glutamic acid, benzoic acid, and the like.

"M" utilized in the reaction schemes that follow represents a leaving group such as halogen, phosphate ester or sulfate ester.

Preparation of Useful Compounds

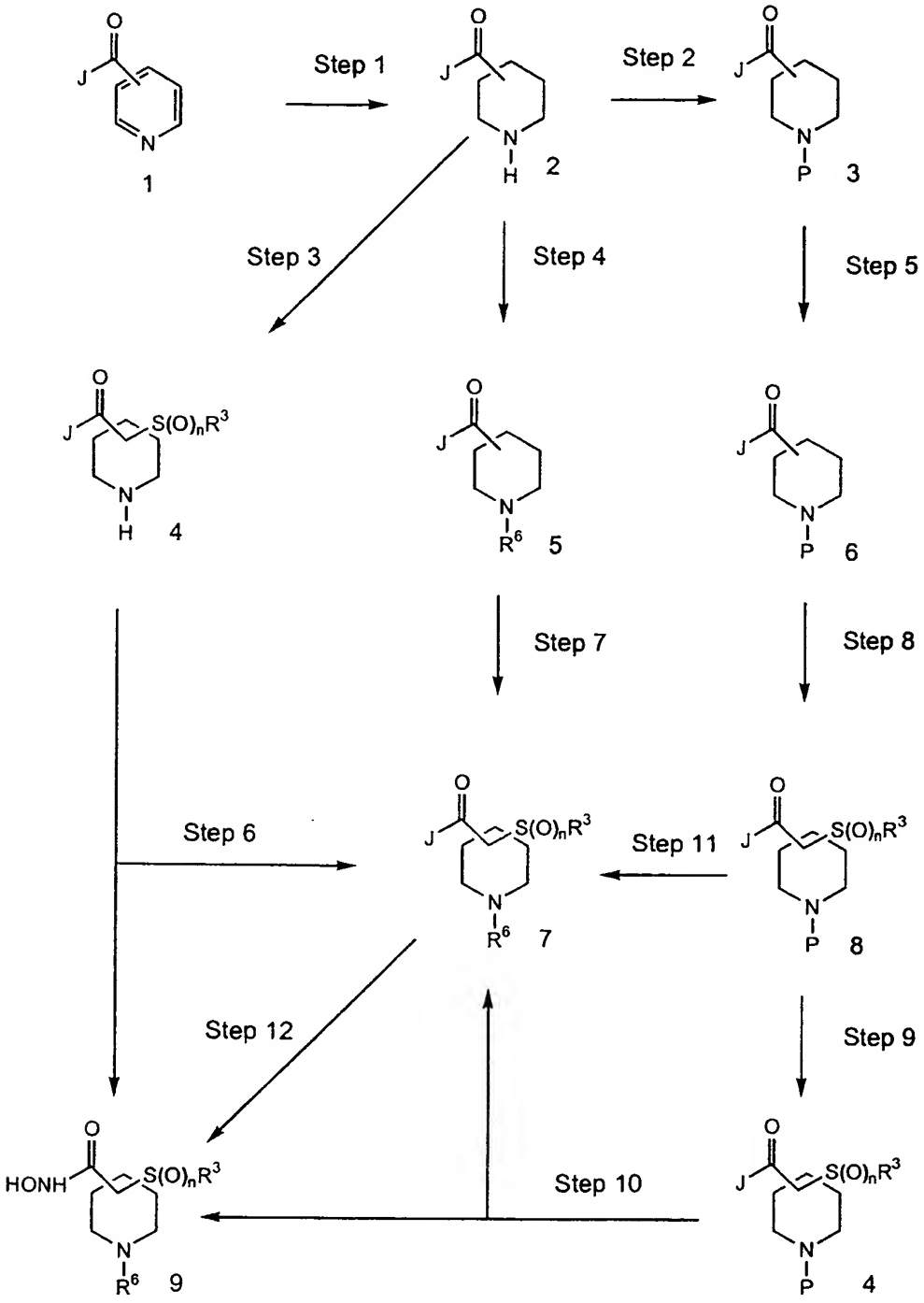
Schemes A through C and Schemes 1 through 19 hereinbelow illustrate chemical processes and transformations that can be useful for the preparation of compounds useful in this invention; i.e., compounds of formulas I, II, III, IV and V and similar cyclic inhibitors. In addition, the preparation of compounds of formula VI and formula VII is illustrated. Compounds of formula VI and formula VII can be used as intermediates in the preparation of the compounds of formulas I, II, III, IV and V or pro-drugs or MMP inhibitors.

In Schemes A through C, the symbol J independently represents R^{20} or other synthetically useful groups such as amides, acid chlorides, mixed anhydrides and the like. The n is 0, 1 or 2 and is preferred to be 1 or 2 in Scheme C. The n of these schemes corresponds to g in formulas VI and VII., and is zero, 1 or 2. The symbol m is 1 or 2. The symbol r is independently 1, 2 or 3. The symbol P represents a protecting group that can also be a member of the group R^6. In Scheme A, for simplicity and clarity of illustration positional isomers are illustrated with a bond through the ring in standard

fashion. Later Schemes typically only show one positional isomer but positional isomers are represented by these structures and reactions in a manner consistent with Formula I, II, III, IV, V, VI, VII above. Similarly, the symbol B represents O, S, SO, SO_2 and NR^6. The symbols C and C' independently are electrophilic groups or groups capable of participating in a condensation reaction. Here to it should be noted that the six-membered ring is shown for illustrative purposes but the procedures and/or reagents are applicable to and represent combinations the permit the preparation of 5- to 8-membered rings.

The structures in Schemes 1 through 19 are also shown with compounds that represent the other compounds of this invention. The aromatic ring in Scheme C is aryl and heteroaryl. The moieties of -A-R-E-Y are as defined before. Reactions illustrated involving a spiroheterocyclic nitrogen atom may not be applicable to those compounds with sulfur or oxygen.

Scheme A


Step 1
Step 2
Step 3
Step 4
Step 5
Step 6
Step 7
Step 8
Step 9
Step 10
Step 11
Step 12
1
2
3
4
5
6
7
8
9
4
J
N
H
P
R6
S(O)nR3
HONH

Scheme A shows in step 1 the reduction of a heteraryl compound to a carboxyl derivative. Generally, the first product is a hydrogen-containing amine heterocycle when the starting material is aromatic or an R^6-containing heterocycle when a partially unsaturated heterocycle is the starting material.

Compound 2 can be treated in several ways depending on the needs of the chemist. In Step 2, the nitrogen can be protected by preparing, for example, a carbobenzoxy (Z) or tert-butoxycarbonyl derivative. Such acylations can be carried out by methods well known in the art, especially the art of amino acid and peptide synthesis. The process of acylation with activated carboxyl group- or activated sulfonyl group-containing reagents to prepare contemplated compounds is carried out in the same manner. Examples of such acylating groups are carbonyl azides, halides, anhydrides, mixed anhydrides, carbodiimide derivatives or other less traditional activated ester groups such as the hydroxybenzotriazole derivative. These acylations can be run in the presence of base including mild bases such as triethylamine or N-ethylmorpholine if desired. The preparation of some activated ester reagents and their use to prepare other compounds useful in this invention is discussed below. It should be recalled that the groups constituting P and serving as a selectively removable protecting group can also be included as part of the group R^6.

Step 4 of Scheme A shows the alkylation or acylation of Compound 2 to produce compound 5. The

process of acylation and alkylation are as discussed herein. In Step 5, the group J can be changed if desired. An example of such a change is exchange of an ester for a THP-protected hydroxamate conversion of a THP-protected hydroxamate inot a hydroxamate or conversion of an acid into a protected hydroxamate or the like.

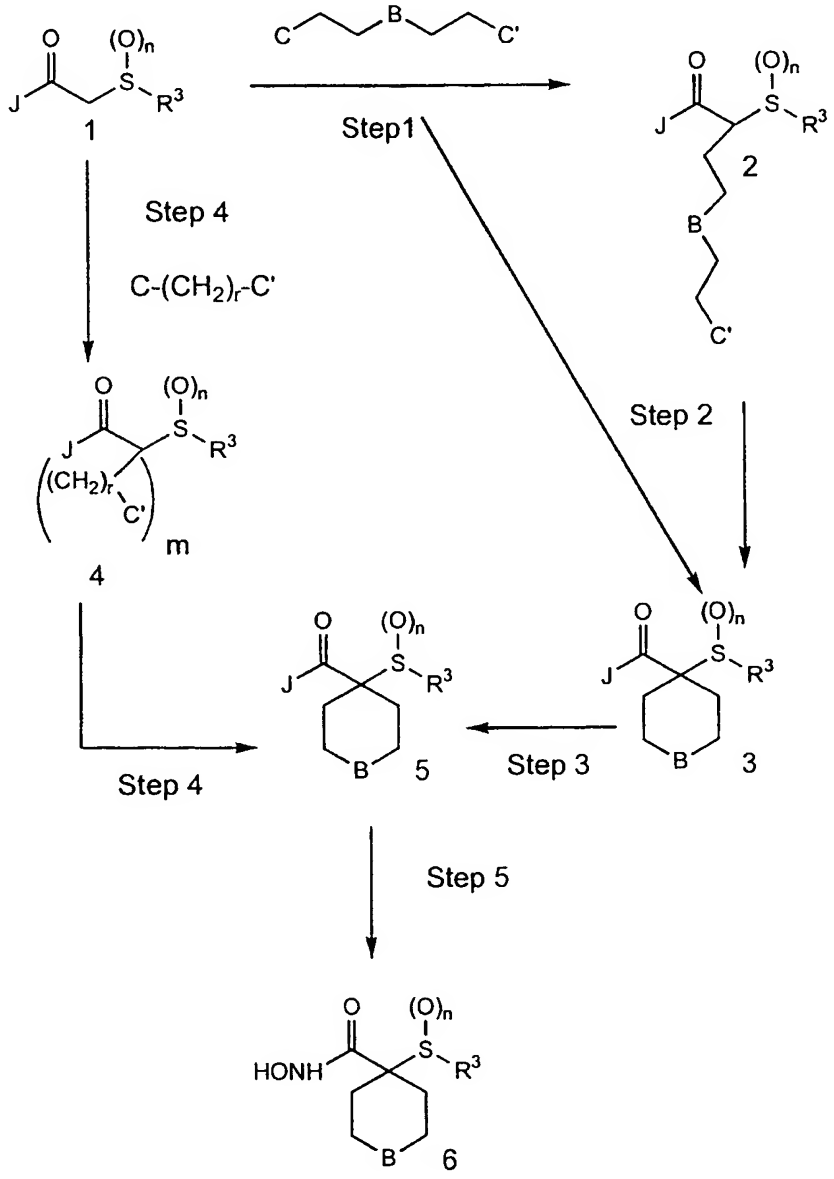
Steps 3, 7 and 8 show the preparation of sulfur-containing derivatives of the contemplated compounds or intermediates to those compounds. The starting material for the above steps (e.g., compounds 2, 5 and 6) can be treated with a base to deprotonate the carbon alpha to the carbonyl function. This anion can be reacted with a sulfur electrophile to produce a sulfone, sulfoxide or sulfide. Such electrophiles can be of the form of, for example, $R^{24}S\text{-}SR^{24}$, $R^{24}SO_2C_1$, $R^{24}SC_1$, $R^{24}SOC_1$, $R^{24}S(O)\text{-}SR_{24}$ and the like where R^{24} is as defined before or is an aryl or heteroaryl sulfur-containing material containing a coupling substituent, $R^{3'}$, that can be used to prepare one of the R^{24}-containing groups. Preparation of the anion requires a base and a strong base may be required such as one of the metal amides, hydrides or alkyls discussed herein. The solvents are nonprotic, and dipolar aprotic solvents are preferred along with an inert atmosphere. Subsequent schemes usually utilize R^3 for the R^{24} group for ease of illustration.

It should be noted that these processes produce sulfides (thio ethers), sulfoxides or sulfones depending on starting material. In

addition, the sulfides can be oxidized to sulfoxides or sulfones, and the sulfoxides can be oxidized to their corresponding sulfone derivatives. The choice of position in the synthetic sequence to change the oxidation state of sulfur as well as the decision to change oxidation state is under the control of the chemist skilled in the art. Methods of oxidizing sulfur are discussed hereinbelow.

Scheme A, Steps 6, 9, 10 and 12 independently illustrate the interconversion of groups within J. Examples of such interconversions include exchange of an ester for hydroxamic acid or hydroxamic acid derivative, conversion of a carboxylic acid into an activated carbonyl derivative or into a hydroxamic acid or hydroxamic acid derivative(pro-drug or protected derivative), or removal of a protecting group from a hydroxamate derivative. The preparation of activated carbonyl compounds their reaction with nucleophiles such as hydroxamic acid, protected hydroxamates or hydroxamic acid pro-drugs is discussed below as is the conversion of protected hydroxamic acid derivatives into hydroxamic acids. The preparation of, for example, hydroxybenzotriazole/carbodiimide, derived products is discussed herein. The preparation or hydrolysis of esters, amides, amide derivatives, acid chlorides, acid anhydrides, mixed anhydrides and the like are synthetic methods very well known in the art, andare not discussed in detail herein. Step 6 illustrates the conversion of compound 4 into compound 9, without first being converted into compound 7.

Scheme B



Scheme B illustrates an alternate method of preparing contemplated compounds. The reagent shown above the arrow in Step 1 is a reagent with two

active groups in addition to the heteroatoms (B) noted before. Here again, the particular reagent illustrated was selected to permit a clear illustration of the reaction, but it is also intended to represent reagents that permit the preparation of the heteroatom position, and 5-, 7- and 8-membered ring size compounds. These reagents are readily selected by those skilled in the art.

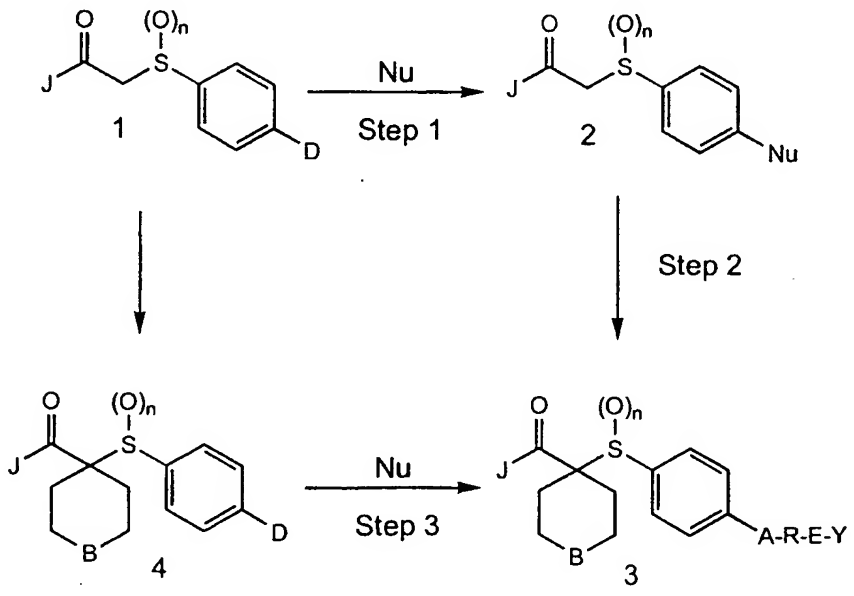
C and C' in this Step 1 reagent are independently an electophile or a group convertible into an electrophile. Such groups include halides, sulfonic acid esters, epoxides, thioepoxides, hydroxyl groups, and the like. This reagent is reacted with a nucleophilic anion of a sulfur containing carbonyl compound such as compound 1. The anion is formed by deprotonation of compound 1 and examples of bases suitable for such a deprotonation are discussed below. Treatment with the above electrophilic reagent is carried out under alkylating conditions well known in the art and discussed herein. The product of this reaction can be either Compound 2 or Compound 3; i.e., the reaction can be carried out as a pot or two step process as required.

Step 3 illustrates the interconversion of J groups if desired as discussed above for Scheme A. Step 4 uses reagent where C, for example, represents a nucleophile as discussed above and C' represents an electrophile or a nucleophile such as hydroxyl, thiol or R^6-amino. It is noted that C' can be, independently, a nucleophile or an electrophile when m is 2; i.e., the C' groups are not required to be the same when m is 2. When m is 2, treatment with a second mole of base provides the skilled chemist an

alternative preparation of Compound 5. When C' is hydroxyl, thiol, or R^6-amino and m is 2, the person skilled in the art can condense Compound 4 with, for example, an aldehyde or ketone, under reductive conditions or with subsequent reduction to form a contemplated compound. As above, the compound where m is 2 can be made in one step (one pot process) or two steps, thus permitting the chemist the choice of having the reagent(s) be the same (one pot) or different (two step).

Scheme B also illustrates the interconversions of the groups within J, the oxidation state of the sulfur and groups on nitrogen; i.e., R^6 groups, to provide the contemplated compounds. These methods and processes are discussed above for the reactions of Scheme A.

Scheme C



Scheme C illustrates the nucleophilic displacement of a group D as defined herein. This reaction is carried out in a similar manner to the displacement reactions discussed herein. The choice of oxidation state of the sulfur is made by the person skilled in the art, but sulfoxide or sulfone groups are preferred, and the sulfone is most preferred. The displacement can be carried out either before or after the methylene next to the carbonyl group is reacted to form a spiro heterocyclic group.

Steps 1, 2 and 3 also illustrate that although the nucleophilic displacement can be carried out with one nucleophile (Nu), the product of this reaction can be modified by methods well known in the art and as shown herein to provide the group -A-R-E-Y as defined hereinbefore.

A non-limiting illustration of such a process is provided when D is fluoride. The fluoride leaving group can be directly displaced with the anion of 4-trifluoromethylphenol, 4-trifluoromethoxyphenol, 4-trifluoromethylthiophenol and the like to provide a contemplated compound. This is a one pot process from Compound 4. Other compounds included in -A-R-E-Y can be prepared by displacing the fluoride leaving group with ammonia to provide an amine, which can then be acylated by methods discussed wherein with, for example, 4-trifluoromethylbenzoyl chloride, to form another contemplated product compound.

The R^6 function can be changed and/or further modified in compounds or at steps in the Schemes as desired or required by the person skilled in the art to prepare the contemplated compounds. Interconversion of dual purpose functional groups such as short or long term protecting groups into other R^6 groups has been mentioned. Many other routine and/or useful conversions, including the preparation of synthetic intermediates, are very well known in the art. A few non-limiting examples of such conversions or reactions include: reductions; nucleophilic displacement/substitution reactions; exchange or preparation of carboxylic or sulfonic acids, amides, esters, acid halides, mixed anhydrides and the like; electrophilic displacement/substitution reactions; oxidations; ring/chain conversions, ring opening reactions, condensation reactions including those involving sulfonyl or carbonyl groups and/or carbon-hydrogen bonds influenced by either or both of those groups. The selection of preparative methods or conversion methods of the contemplated compounds and the order of the reaction(s) is made by the skilled person. It is expected that should a particular sequence or method prove to be undesirable that an alternative will be selected and used. Included is the choice of preparing/adding the groups in a single step using a convergent inhibitor strategy or preparing the final R^6 group following a stepwise strategy.

Thus, in general, the choices of starting material and reaction conditions can vary as is well known to those skilled in the art. Usually, no

single set of conditions is limiting because variations can be applied as required. Conditions are also selected as desired to suit a specific purpose such as small scale preparations or large scale preparations. In either case, the use of less safe or less environmentally sound materials or reagents is usually be minimized. Examples of such materials are diazomethane, diethyl ether, heavy metal salts, dimethyl sulfide, chloroform, benzene and the like.

These reactions can be carried out under a dry inert atmosphere such a nitrogen or argon if desired. Selected reactions known to those skilled in the art, can be carried out under a dry atmosphere such as dry air whereas other synthetic steps, for example, aqueous acid or base ester or amide hydrolysis, can be carried out under laboratory air. In addition, some processes of these syntheses can be carried out in a pressure apparatus at pressures above, equal to or below atmospheric pressure. The use of such an apparatus aids in the control of gaseous reagents such as hydrogen, ammonia, trimethylamine, methylamine, oxygen and the like, and can also help prevent the leakage of air or humidity into a reaction in progress. This discussion is not intended to be exhaustive as it is readily noted that additional or alternative methods, conditions, reactions or systems can be identified and used by a chemist of ordinary skill.

The illustrated reactions are usually carried out at a temperature of between -25°C to solvent reflux under an inert atmosphere such as nitrogen or argon. The solvent or solvent mixture

can vary widely depending upon reagents and other conditions and can include polar or dipolar aprotic solvents as listed or mixtures of these solvents. Reactions can be carried out at lower temperatures such as dry ice/acetone or liquid nitrogen temperature if desired to carry out such reactions as metalations or anion formations using strong bases.

In some cases, amines such as triethylamine, pyridine or other non-reactive bases can serve as reagents and/or solvents and/or co-solvents. In some instances, in these reactions and other reactions in these Schemes, protecting groups can be used to maintain or retain groups in other parts of a molecule(s) at locations that is(are) not desired reactive centers. Examples of such groups that the skilled person can maintain or retain include, amines, other hydroxyls, thiols, acids and the like. Such protecting groups can include acyl groups, arylalkyl groups, carbamoyl groups, ethers, alkoxyalkyl ethers, cycloalkyloxy ethers, arylalkyl groups, silyl groups including trisubstituted silyl groups, ester groups and the like. Examples of such protecting groups include acetyl, trifluoroacetyl, tetrahydropyran (THP), benzyl, tert-butoxy carbonyl (BOC or TBOC), benzyloxycarbonyl (Z or CBZ), tert-butyldimethylsilyl (TBDMS) or methoxyethoxymethylene (MEM) groups. The preparation of such protected compounds as well as their removal is well known in the art. The protecting groups can also be used as substituents in the contemplated compounds whose utility is as a drug rather than as a synthetic intermediate.

Many reactions or processes involve bases that can act as reactants, reagents, deprotonating agents, acid scavengers, salt forming reagents, solvents, co-solvents and the like. Bases that can be used include, for example, metal hydroxides such as sodium, potassium, lithium, cesium or magnesium hydroxide, oxides such as those of sodium, potassium, lithium, calcium or magnesium, metal carbonates such as those of sodium, potassium, lithium, cesium, calcium or magnesium, metal bicarbonates such as sodium bicarbonate or potassium bicarbonate, primary (I°), secondary (II°) or tertiary (III°) organic amines such as alkyl amines, arylalkyl amines, alkylarylalkyl amines, heterocyclic amines or heteroaryl amines, ammonium hydroxides or quaternary ammonium hydroxides. As non-limiting examples, such amines can include triethylamine, trimethylamine, diisopropylamine, methyldiisopropylamine, diazabicyclononane, tribenzylamine, dimethylbenzylamine, morpholine, N-methylmorpholine, N,N'-dimethylpiperazine, N-ethylpiperidine, 1,1,5,5-tetramethylpiperidine, dimethylaminopyridine, pyridine, quinoline, tetramethylethylenediamine, and the like. Non-limiting examples of ammonium hydroxides, usually made from amines and water, can include ammonium hydroxide, triethylammonium hydroxide, trimethylammonium hydroxide, methyldiiospropylammonium hydroxide, tribenzylammonium hydroxide, dimethylbenzylammonium hydroxide, morpholinium hydroxide, N-methylmorpholinium hydroxide, N,N'-dimethylpiperazinium hydroxide, N-ethylpiperidinium hydroxide, and the like. As non-limiting examples,

quaternary ammonium hydroxides can include tetraethylammonium hydroxide, tetramethylammonium hydroxide, dimethyldiiospropyl-ammonium hydroxide, benzylmethyldiisopropylammonium hydroxide, methyldiazabicyclononylammonium hydroxide, methyltribenzylammonium hydroxide, N,N-dimethyl-morpholiniumhydroxide, N,N,N',N'-tetramethylpiperazinium hydroxide, and N-ethyl-N'-hexylpiperidinium hydroxide and the like.

Metal hydrides, amides or alcoholates such as calcium hydride, sodium hydride, potassium hydride, lithium hydride, aluminum hydride, diisobutylaluminum hydride (DIBAL) sodium methoxide, potassium tert-butoxide, calcium ethoxide, magnesium ethoxide, sodium amide, potassium diisopropyl amide and the like can also be suitable reagents. Organometallic deprotonating agents such as alkyl or aryl lithium reagents such as methyl lithium, phenyl lithium, tert-butyl lithium, lithium acetylide or butyl lithium, Grignard reagents such as methylmagnesium bromide or methymagnesium chloride, organocadmium reagents such as dimethylcadmium and the like can also serve as bases for causing salt formation or catalyzing the reaction. Quaternary ammonium hydroxides or mixed salts are also useful for aiding phase transfer couplings or serving as phase transfer reagents. Pharmaceutically acceptable bases can be reacted with acids to form contemplated pharmaceutically acceptable salts. It should also be noted that optically active bases can be used to make optically active salts which can be used for optical resolutions.

Generally, reaction media can comprise a single solvent, mixed solvents of the same or different classes or serve as a reagent in a single or mixed solvent system. The solvents can be protic, non-protic or dipolar aprotic. Non-limiting examples of protic solvents include water, methanol (MeOH), denatured or pure 95% or absolute ethanol, isopropanol and the like. Typical non-protic solvents include acetone, tetrahydrofuran (THF), dioxane, diethyl ether, tert-butylmethyl ether (TBME), aromatics such as xylene, toluene, or benzene, ethyl acetate, methyl acetate, butyl acetate, trichloroethane, methylene chloride, ethylenedichloride (EDC), hexane, heptane, isooctane, cyclohexane and the like. Dipolar aprotic solvents include compounds such as dimethylformamide (DMF), dimethylacetamide (DMAc), acetonitrile, DMSO, hexamethylphosphorus triamide (HMPA), nitromethane, tetramethylurea, N-methylpyrrolidone and the like. Non-limiting examples of reagents that can be used as solvents or as part of a mixed solvent system include organic or inorganic mono- or multi-protic acids or bases such as hydrochloric acid, phosphoric acid, sulfuric acid, acetic acid, formic acid, citric acid, succinic acid, triethylamine, morpholine, N-methylmorpholine, piperidine, pyrazine, piperazine, pyridine, potassium hydroxide, sodium hydroxide, alcohols or amines for making esters or amides or thiols for making contemplated products and the like.

The preparation of compounds contemplated herein can require the oxidation of nitrogen or sulfur to N-oxide derivatives or sulfoxides or sulfones. Reagents for this process can include, in

a non-limiting example, peroxymonosulfate (OXONE®), hydrogen peroxide, meta-chloroperbenzoic acid, perbenzoic acid, peracetic acid, perlactic acid, tert-butyl peroxide, tert-butyl hypochlorite, sodium hydpochlorite, hypochlorous acid, sodium meta-periodate, periodic acid and the like with the weaker agents being most useful for the preparation of sulfones and sulfoxides. Protic, non-protic, dipolar aprotic solvents, either pure or mixed, can be chosen, for example, methanol/water.

The oxidation can be carried out at temperature of about -78° to about 50° degrees Centigrade, and normally selected from a range -10°C to about 40°C. Sulfoxides are best prepared using one equivalent of oxidizing agent. It can be desirable in the case of more active oxidizing agents, but not required, that the reactions be carried out under an inert gas atmosphere with or without degassed solvents. It should be noted that the oxidation of sulfides to sulfones can be carried out in one step or two steps via the sulfoxide as desired by the chemist.

Reduction is a well known process in the art with a useful method being hydrogenation. In such cases (catalytic reduction), there can be a metal catalyst such as Rh, Pd, Pt, Ni or the like with or without an additional support such as carbon, barium carbonate and the like. Solvents can be protic or non-protic pure solvents or mixed solvents as required. The reductions can be carried out at atmospheric pressure to a pressure of multiple atmospheres with atmospheric pressure to about 40 pounds per square inch (psi) preferred or very high

pressures in special hydrogenation equipment well known in the art.

Reductive alkylation of amines or active methylene compounds is also a useful method of preparing compounds. Such alkylations can be carried out under reductive hydrogenation conditions as presented above using, for example, aldehydes or ketones. Hydride transfer reagents such as sodium cyanoborohydride, aluminum hydride, lithium aluminumhydride, borane, sodium borohydride, di-isobutylaluminum hydride and the like are also useful as reagents for reductive alkylation. Acyl groups can be reduced in a similar manner to produce substituted amines.

Alternative methods of alkylating carbon or nitrogen are direct alkylation. Such an alkylation, as is well known in the art, can be carried by treatment of an activated carbon containing at least one hydrogen with base to form the corresponding anion, adding an electrophilic reagent and permitting the SN2 reaction to proceed. An amine to be alkylated is treated similarly except that deprotonation may not be required. Electrophiles include halogen derivatives, sulfonate esters, epoxides and the like.

Bases and solvents for alkylation reactions are those discussed above. Preferred are bases that are hindered such that competition with the electrophile is minimized. Additional preferred bases are metal hydrides, amide anions or organometallic bases such as n-butyl lithium. The solvents, solvent mixtures or solvent/reagent mixtures discussed are satisfactory but non-protic or

dipolar aprotic solvents such as acetone, acetonitrile, DMF and the like are examples of preferred classes.

Acids are used in many reactions during various syntheses. For example, removal of the THP protecting group to produce the hydroxamic acid. The acid can be a mono-, di- or tri-protic organic or inorganic acid. Examples of acids include hydrochloric acid, phosphoric acid, sulfuric acid, acetic acid, formic acid, citric acid, succinic acid, hydrobromic acid, hydrofluoric acid, carbonic acid, phosphorus acid, p-toluene sulfonic acid, trifluoromethane sulfonic acid, trifluoroacetic acid, difluoroacetic acid, benzoic acid, methane sulfonic acid, benzene sulfonic acid, 2,6-dimethylbenzene sulfonic acid, trichloroacetic acid, nitrobenzoic acid, dinitrobenzoic acid, trinitrobenzoic acid, and the like. They can also be Lewis acids such as aluminum chloride, borontrifluoride, antimony pentafluoride and the like. Acids in a protic can also be used to hydrolyze esters, amides and the like as well as catalyze exchange reactions.

Conversion of a carboxylic acid protected as an ester or amide into a hydroxamic acid or hydroxamic acid derivative such as an O-arylalkylether or O-cycloalkoxyalkylether group is useful. In the case where hydroxylamine is used, treatment of an ester or amide with one or more equivalents of hydroxylamine hydrochloride at room temperature or above in a solvent or solvents, usually protic or partially protic, such as those listed above can provide a hydroxamic acid directly. This exchange process can be further catalyzed by the

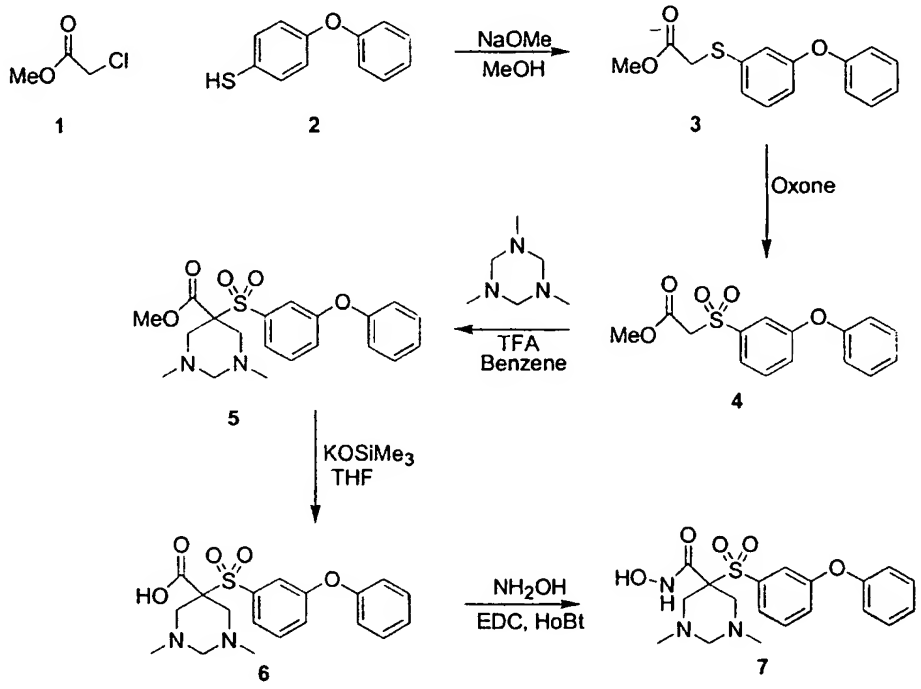
addition of additional acid. Alternatively, a base such as a salt of an alcohol used as a solvent, for example, sodium methoxide in methanol, can be used to form hydroxylamine from hydroxylamine hydrochloride in situ which can exchange with an ester or amide. As mentioned above, exchange can be carried out with a protected hydroxyl amine such as tetrahydropyranylhydroxyamine ($THPONH_2$), benzylhydroxylamine ($BnONH_2$), and the like in which case compounds such as shown in Schemes A, B and C that are tetrahydropyranyl (THP) or benzyl (Bn) hydroxamic acid derivatives are the products. Removal of the protecting groups when desired, for example, following further transformations in another part of the molecule or following storage, is accomplished by standard methods well known in the art such as acid hydrolysis of the THP group as discussed above or reductive removal of the benzyl group with hydrogen and a metal catalyst such as palladium, platinum, palladium on carbon or nickel.

In the case where R^{20} is hydroxyl; i.e., where the intermediate is a carboxylic acid, standard coupling reactions can be used. For example, the acid can be converted into an acid chloride, mixed anhydride or activated ester such as hydroxybenzotriazole and treated with hydroxylamine or a protected hydroxylamine in the presence of a non-competitive base to the nitrogen acylated compound. This is the same product as discussed above. Couplings of this nature are well known in the art and especially the art related to peptide and amino acid chemistry.

Compounds contemplated herein can possess one or more asymmetric carbon atoms and are thus capable of existing in the form of optical isomers, enantiomers, diastereoisomers, as well as in the form of racemic or nonracemic mixtures. A compound can also exist in other isomeric forms such as ortho, meta and para isomers, cis and trans isomers, syn and anti isomers, E and Z isomers, tautomeric isomers, alpha and beta isomers, axial and equatorial isomers and isomers due to hindered rotation. An isomer can exist in equilibrium with another isomer in a mammal or a test system. Such a compound can also exist as an isomeric equilibrium system with a solvent or water, for example, as a hydrated ketone or aldehyde, as is well known in the art. All isomers are included as compounds of this invention.

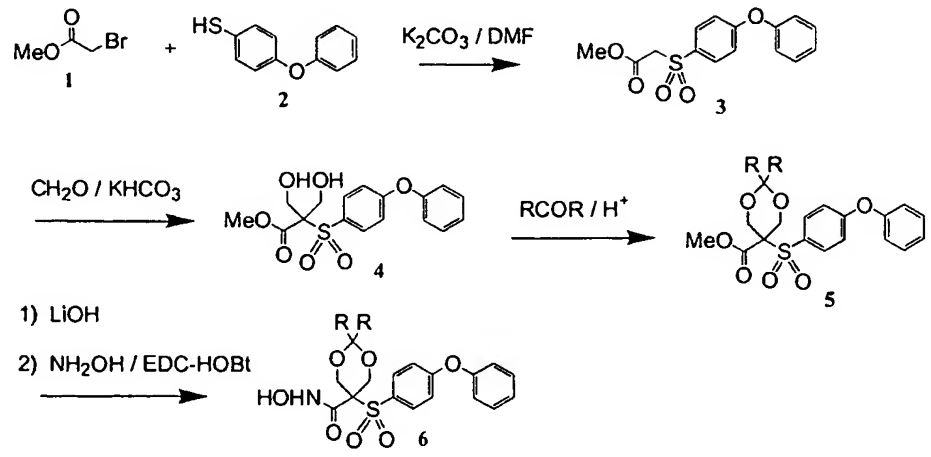
The chemical reactions described above are generally disclosed in terms of their broadest application to the preparation of the compounds of this invention. Occasionally, the reactions may not be applicable as described to each compound included within the disclosed scope. The compounds for which this occurs will be readily recognized by those skilled in the art. In all such cases, either the reactions can be successfully performed by conventional modifications known to those skilled in the art, e.g., by appropriate protection of interfering groups, by changing to alternative conventional reagents, by routine modification of reaction conditions, and the like, or other reactions disclosed herein or otherwise conventional, are applicable to the preparation of the corresponding compounds that are contemplated.

Scheme 1

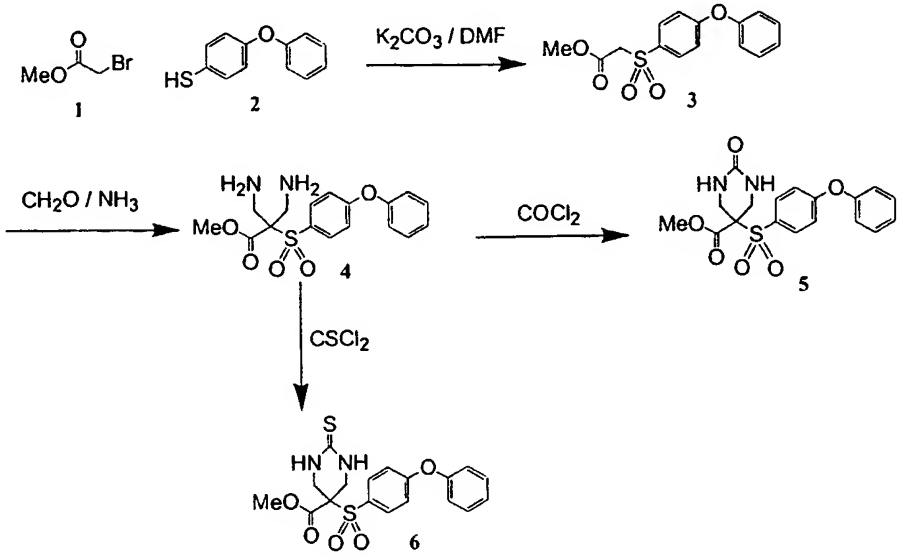


5

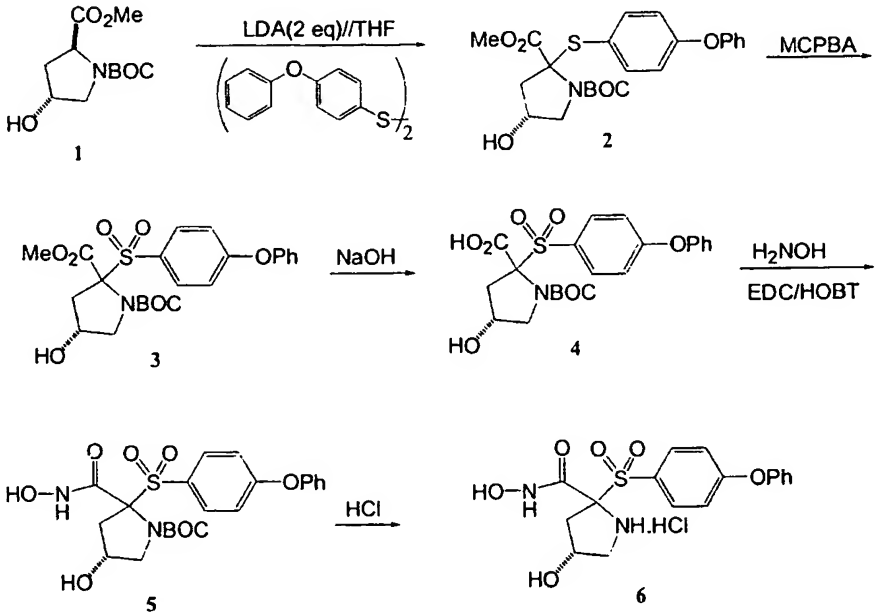
Scheme 2



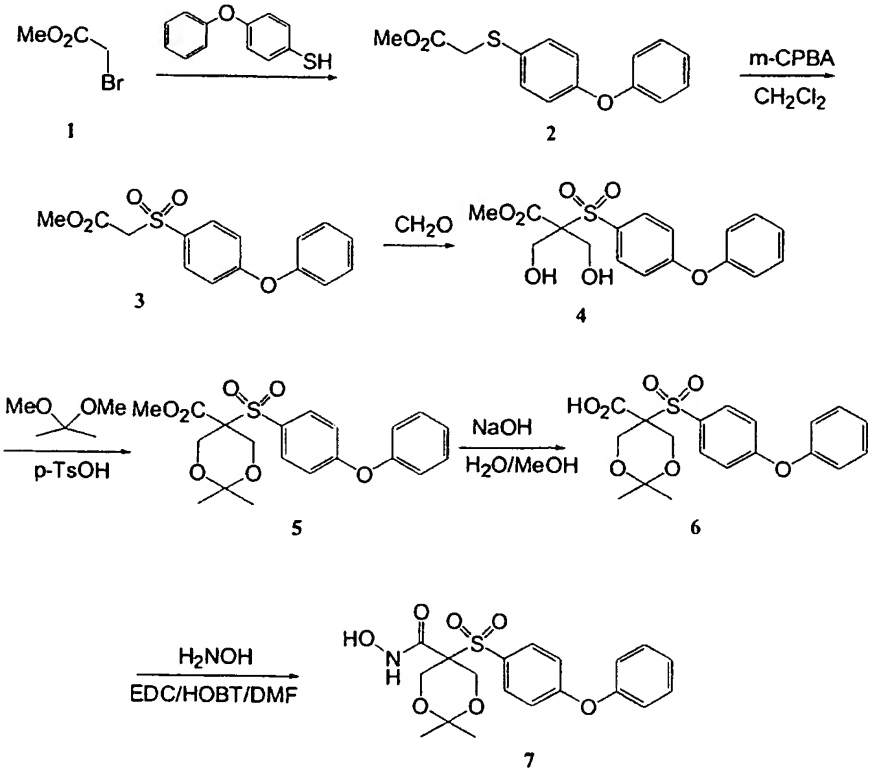
Scheme 3



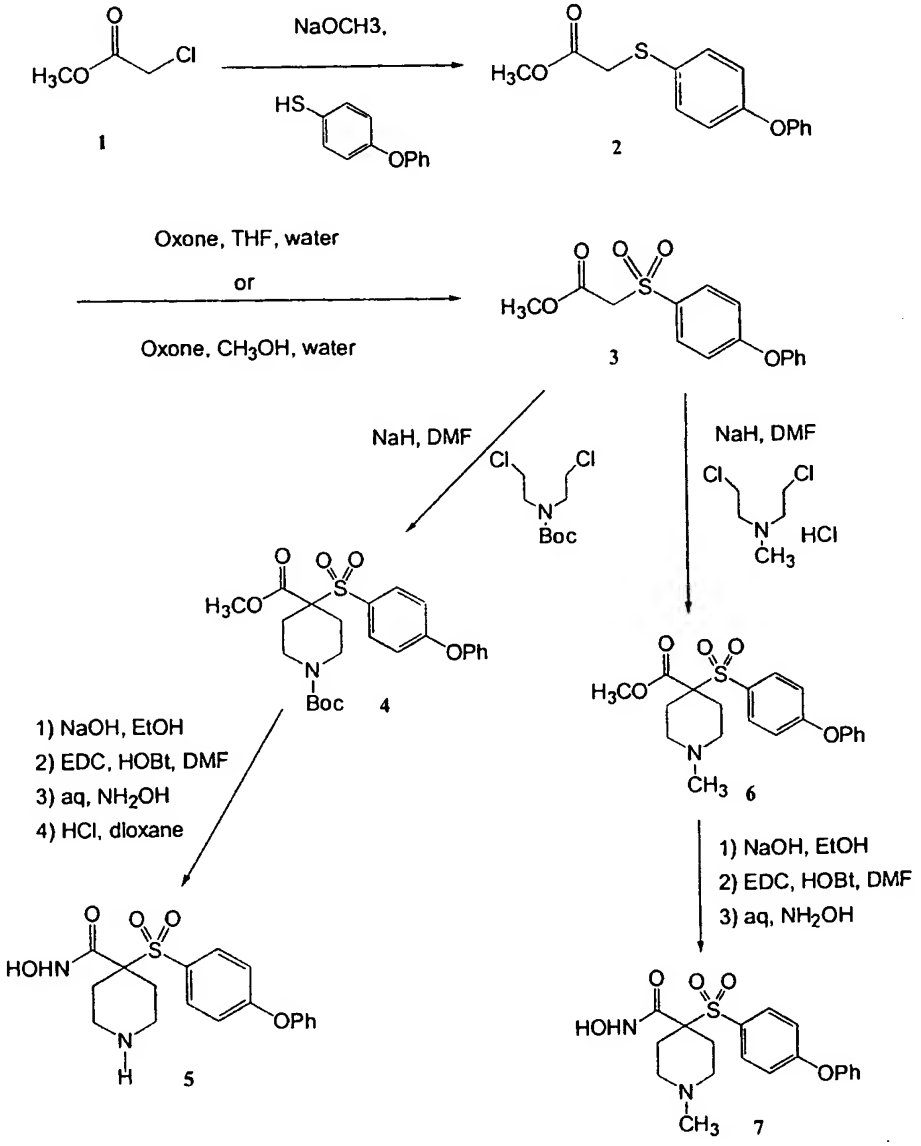
Scheme 4



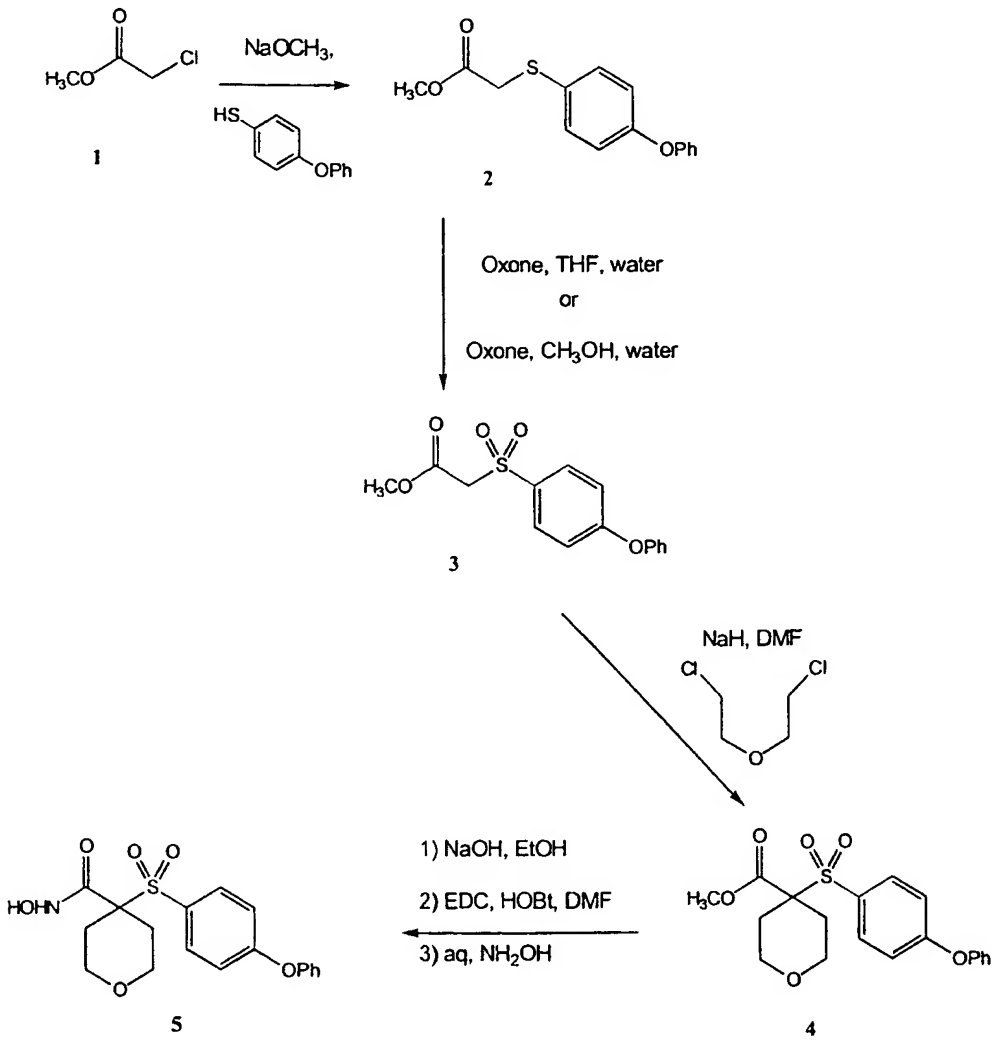
Scheme 5


MeO2C
Br
SH
1
MeO2C
S
O
2
m-CPBA
CH2Cl2
MeO2C
S
O
O
3
CH2O
MeO2C
S
O
O
OH
OH
4
MeO
OMe
p-TsOH
MeO2C
S
O
O
5
NaOH
H2O/MeOH
HO2C
S
O
O
6
H2NOH
EDC/HOBT/DMF
HO
N
H
O
S
O
O
7

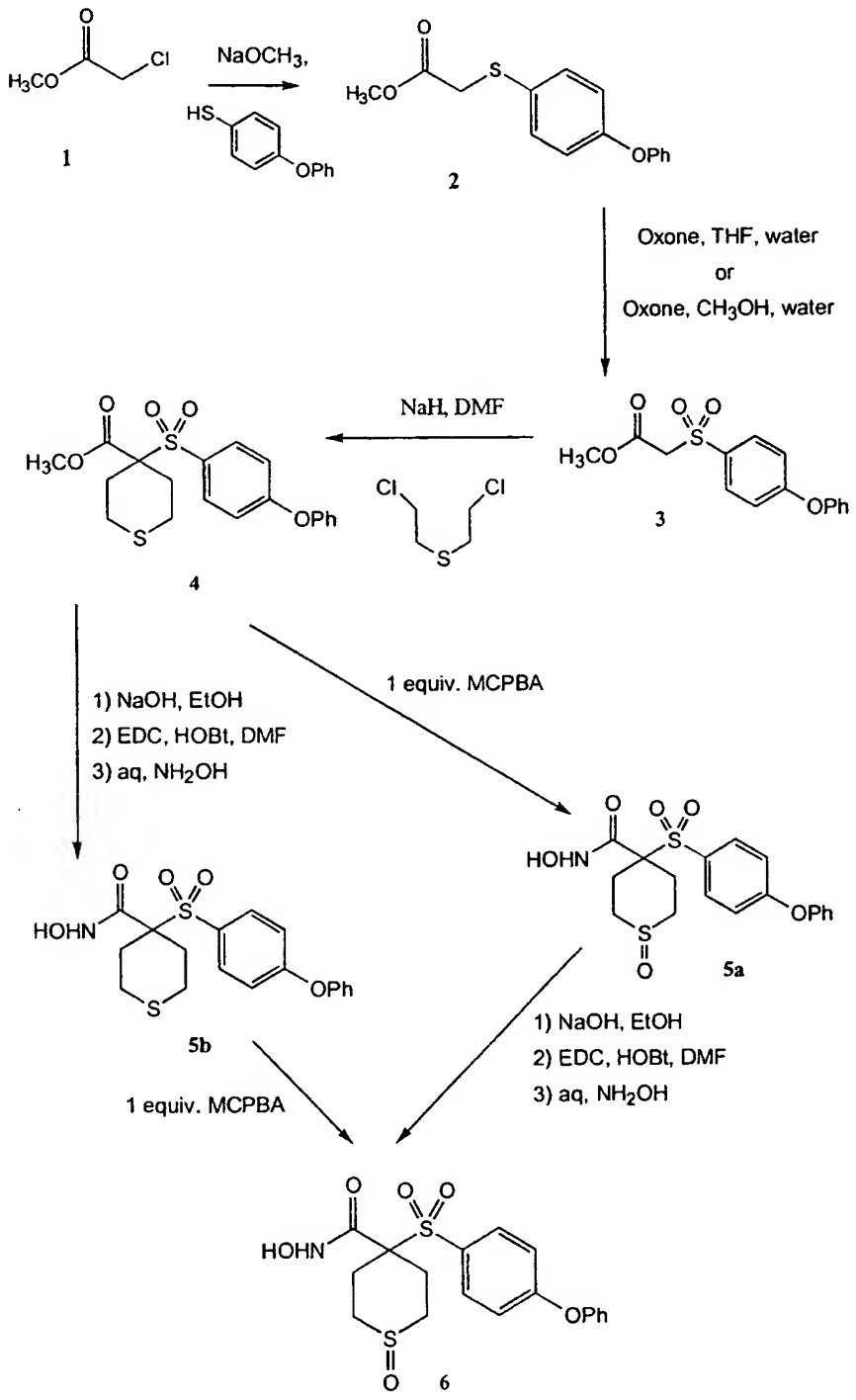
Scheme 6


NaOCH3,
1
2
Oxone, THF, water
or
Oxone, CH3OH, water
3
NaH, DMF
Boc
4
NaH, DMF
HCl
6
1) NaOH, EtOH
2) EDC, HOBt, DMF
3) aq, NH2OH
4) HCl, dioxane
5
1) NaOH, EtOH
2) EDC, HOBt, DMF
3) aq, NH2OH
7

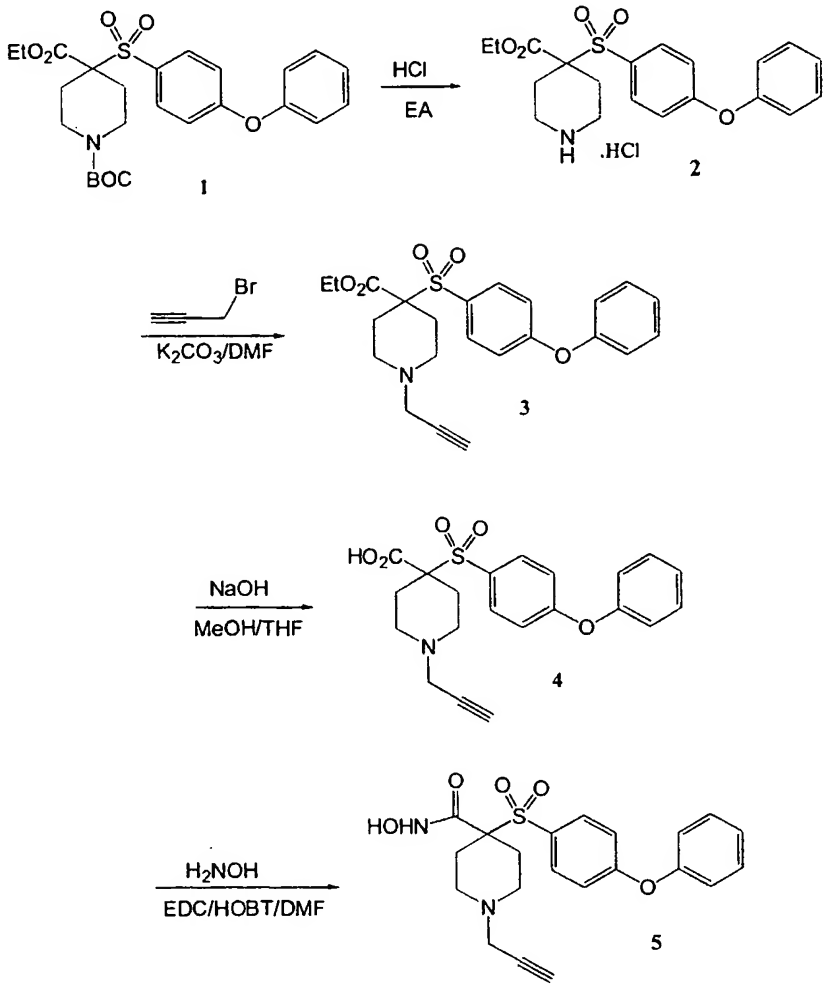
Scheme 7


NaOCH3,
1
2
Oxone, THF, water
or
Oxone, CH3OH, water
3
NaH, DMF
1) NaOH, EtOH
2) EDC, HOBt, DMF
3) aq, NH2OH
4
5

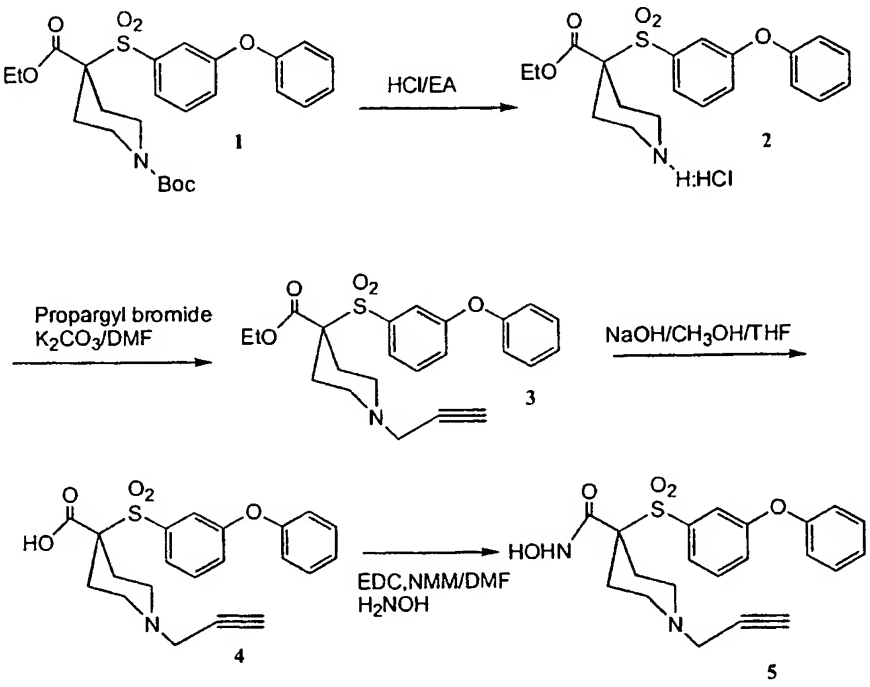
Scheme 8


NaOCH3,
1
2
Oxone, THF, water
or
Oxone, CH3OH, water
3
NaH, DMF
4
1) NaOH, EtOH
2) EDC, HOBt, DMF
3) aq, NH2OH
1 equiv. MCPBA
5a
5b
1) NaOH, EtOH
2) EDC, HOBt, DMF
3) aq, NH2OH
1 equiv. MCPBA
6

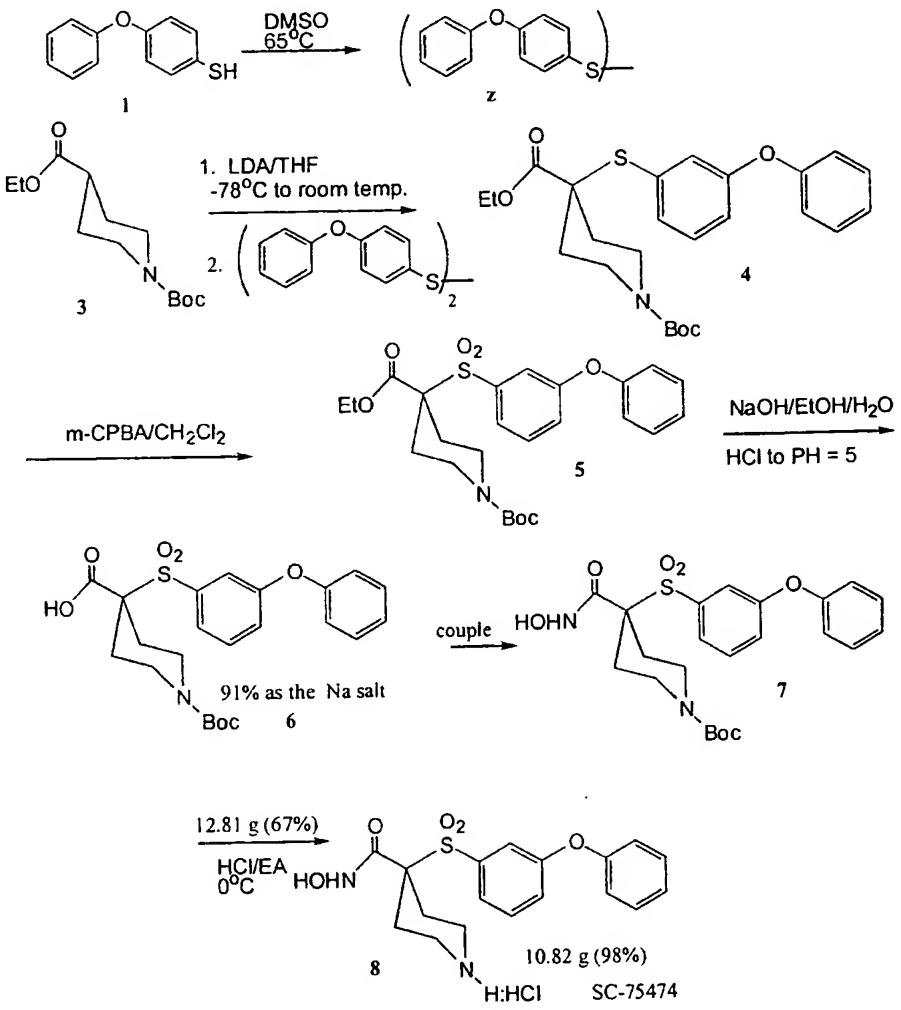
Scheme 9


EtO2C
S
O
O
N
BOC
1
HCl
EA
EtO2C
S
O
O
N
H
.HCl
2
Br
K2CO3/DMF
EtO2C
S
O
O
N
3
NaOH
MeOH/THF
HO2C
S
O
O
N
4
H2NOH
EDC/HOBT/DMF
HOHN
O
S
O
O
N
5

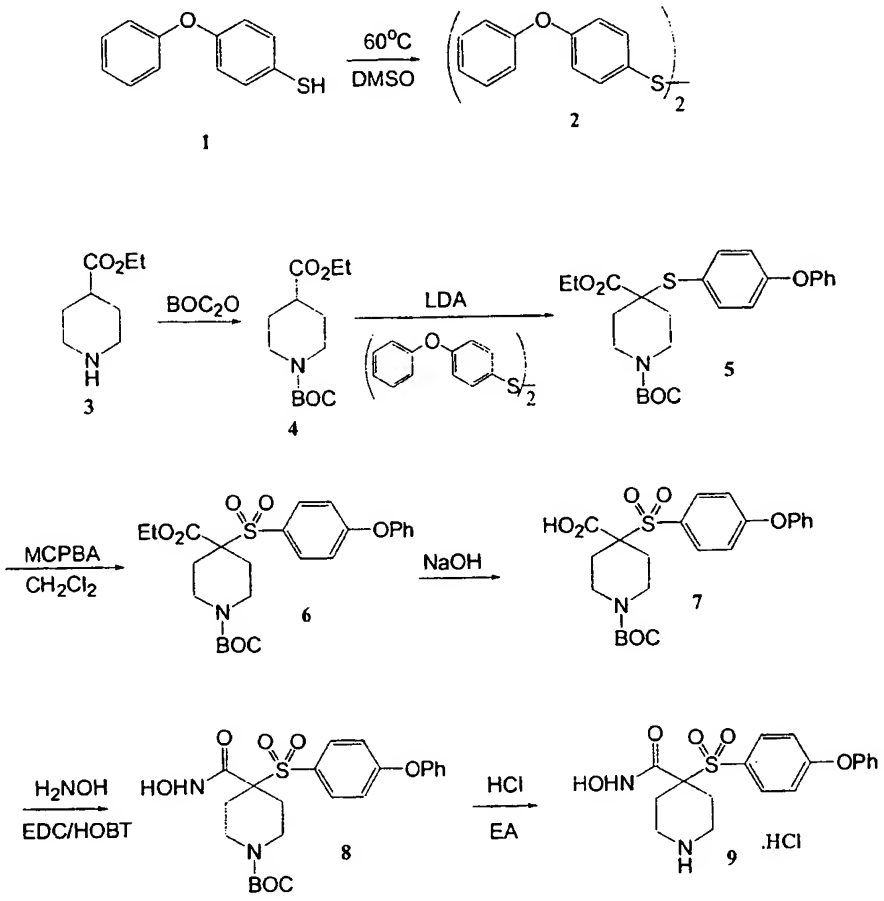
Scheme 10


EtO
O
O2
S
O
N
Boc
1
HCl/EA
H:HCl
2
Propargyl bromide
K2CO3/DMF
3
NaOH/CH3OH/THF
HO
4
EDC,NMM/DMF
H2NOH
HOHN
5

Scheme 11

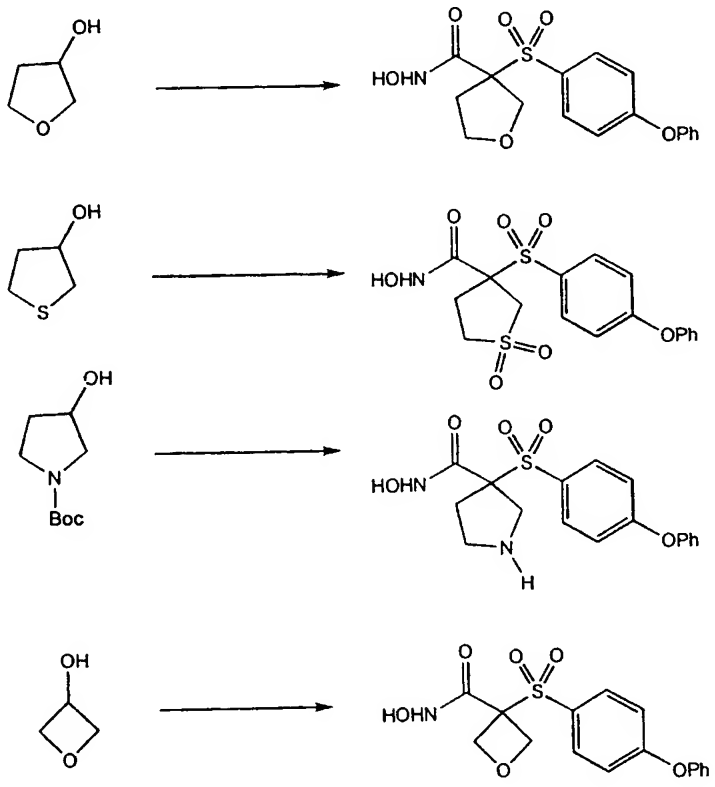

DMSO
65°C
SH
1
z
EtO
1. LDA/THF
-78°C to room temp.
2.
3
Boc
4
m-CPBA/CH2Cl2
5
NaOH/EtOH/H2O
HCl to PH = 5
HO
91% as the Na salt
6
couple
HOHN
7
12.81 g (67%)
HCl/EA
0°C
8
10.82 g (98%)
H:HCl
SC-75474

Scheme 12

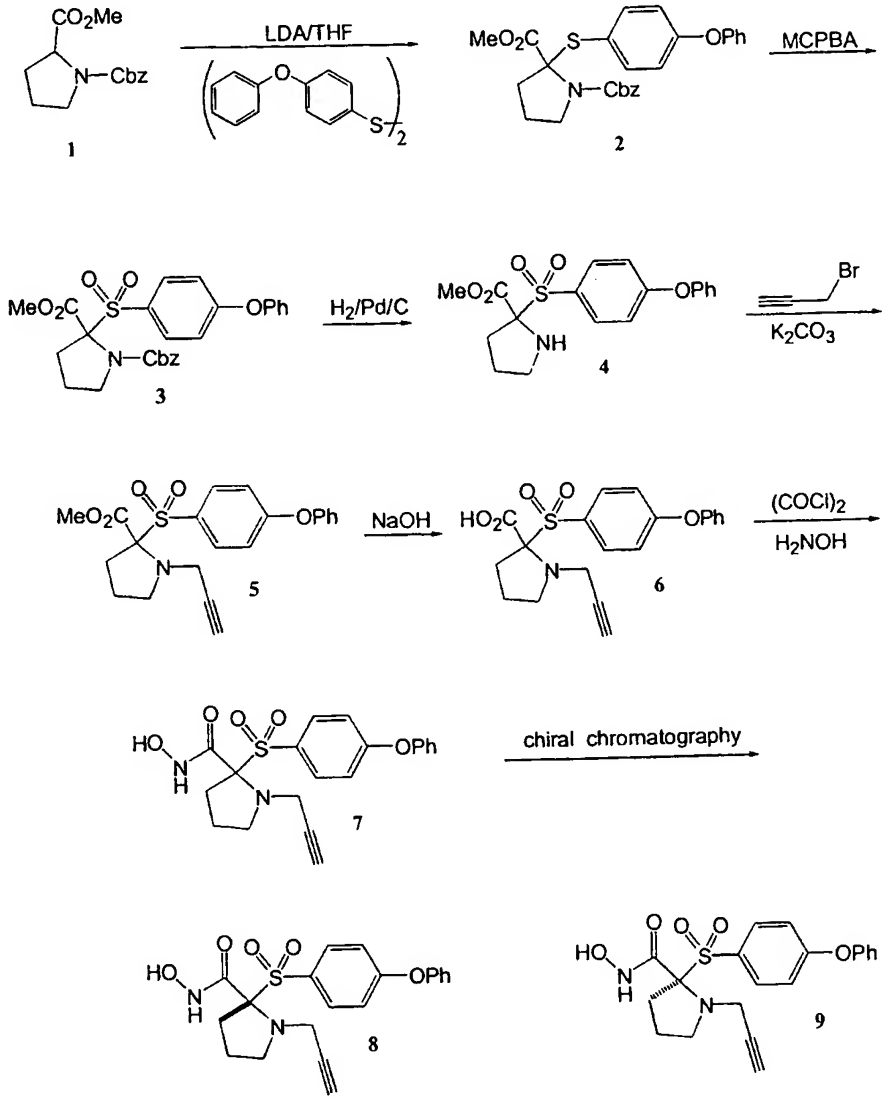

60°C
DMSO
SH
1
2
CO2Et
BOC2O
LDA
EtO2C
OPh
BOC
3
4
5
MCPBA
CH2Cl2
NaOH
HO2C
6
7
H2NOH
EDC/HOBT
HOHN
HCl
EA
8
9
.HCl

Scheme 13

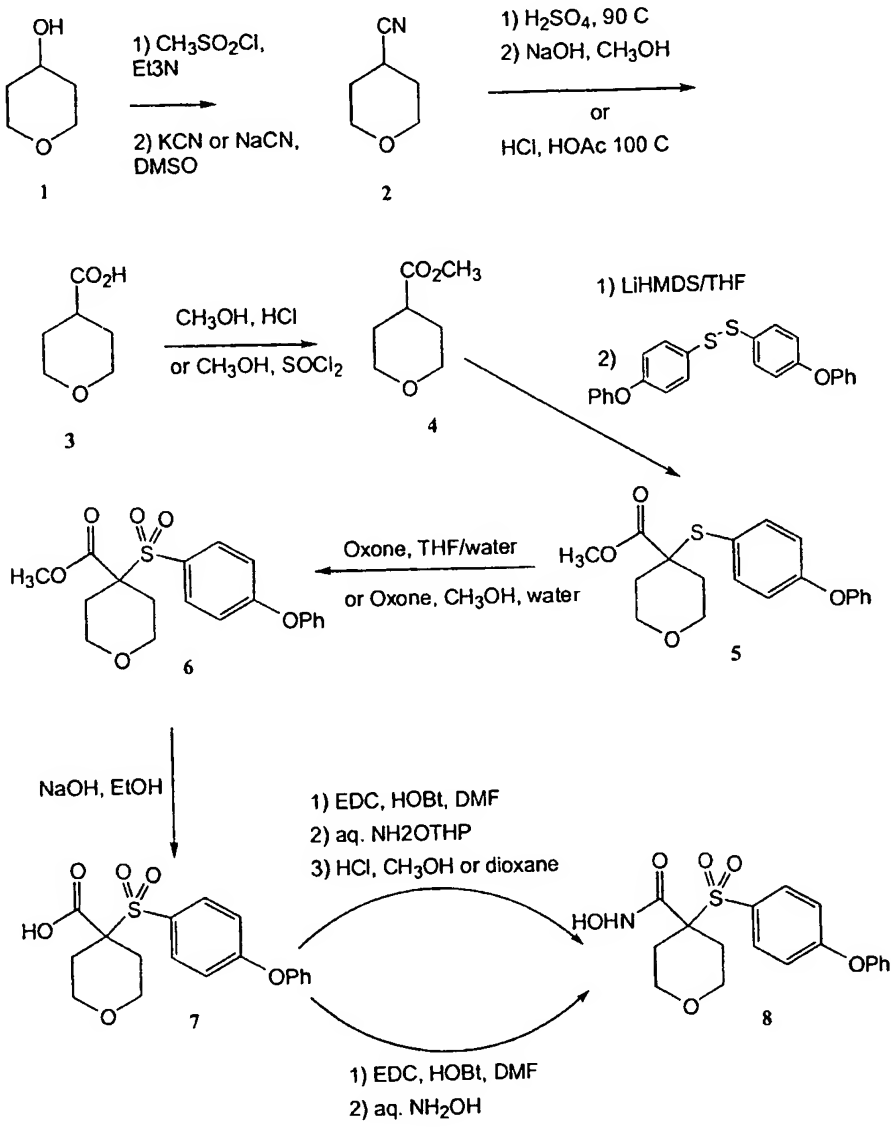
In a similar manner, the following analogs can be made.



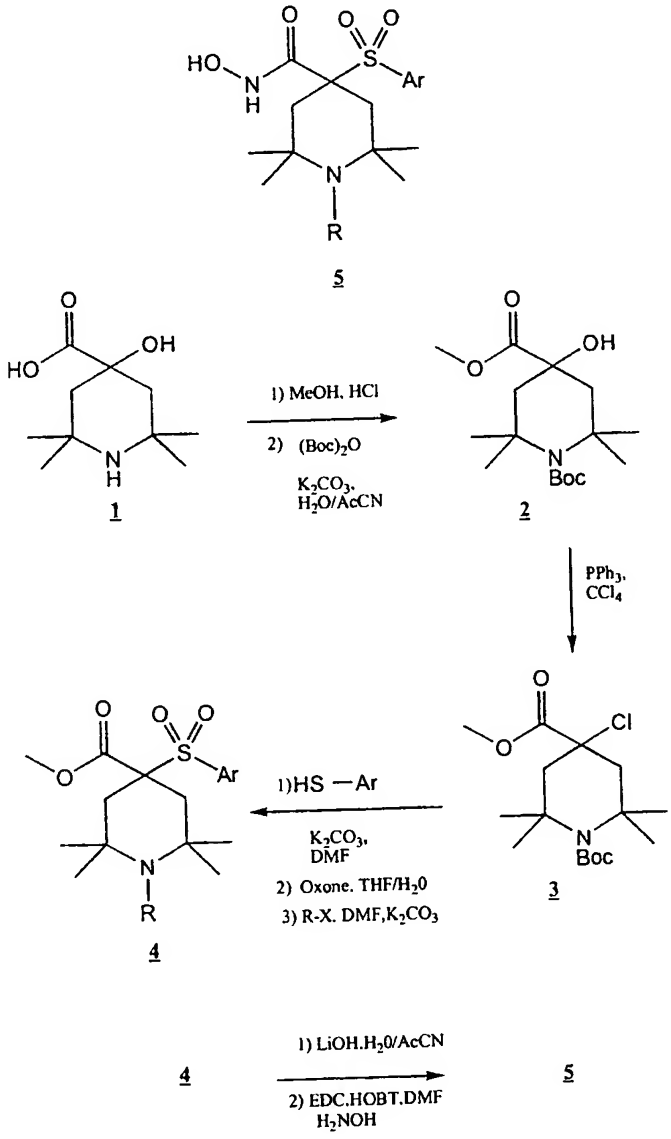
Scheme 14


CO2Me
N—Cbz
1
LDA/THF
O
S
2
MeO2C
S
OPh
N—Cbz
2
MCPBA
MeO2C
OPh
N—Cbz
3
H2/Pd/C
MeO2C
OPh
NH
4
Br
K2CO3
MeO2C
OPh
5
NaOH
HO2C
OPh
6
(COCl)2
H2NOH
HO
N
H
OPh
7
chiral chromatography
HO
N
H
OPh
8
HO
N
H
OPh
9

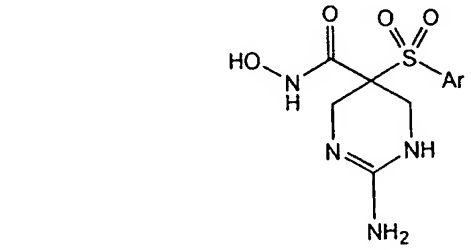
Scheme 15


OH
1) CH_3SO_2Cl, Et3N
2) KCN or NaCN, DMSO
CN
1) H_2SO_4, 90 C
2) NaOH, CH_3OH
or
HCl, HOAc 100 C
CO_2H
CH_3OH, HCl
or CH_3OH, $SOCl_2$
CO_2CH_3
1) LiHMDS/THF
2)
PhO
OPh
Oxone, THF/water
or Oxone, CH_3OH, water
H_3CO
NaOH, EtOH
1) EDC, HOBt, DMF
2) aq. NH2OTHP
3) HCl, CH_3OH or dioxane
HO
HOHN
1) EDC, HOBt, DMF
2) aq. NH_2OH
1
2
3
4
5
6
7
8

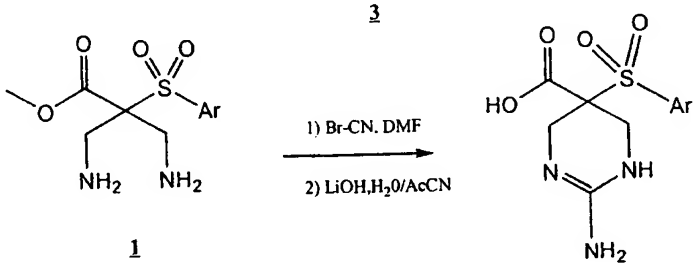
Scheme 16


HO
N
H
O
O
O
S
Ar
N
R
5
HO
OH
O
N
H
1
1) MeOH, HCl
2) (Boc)2O
K2CO3,
H2O/AcCN
O
OH
O
N
Boc
2
PPh3,
CCl4
O
Cl
O
N
Boc
3
1)HS —Ar
K2CO3,
DMF
2) Oxone. THF/H20
3) R-X. DMF,K2CO3
O
O
O
S
Ar
O
N
R
4
4
1) LiOH.H20/AcCN
2) EDC.HOBT.DMF
H2NOH
5

Scheme 17



3



1) Br-CN. DMF

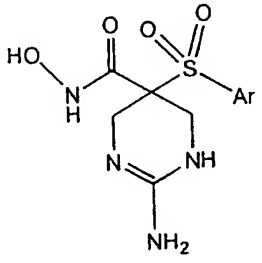
2) LiOH,$H_2$0/AcCN

1

from Scheme 3

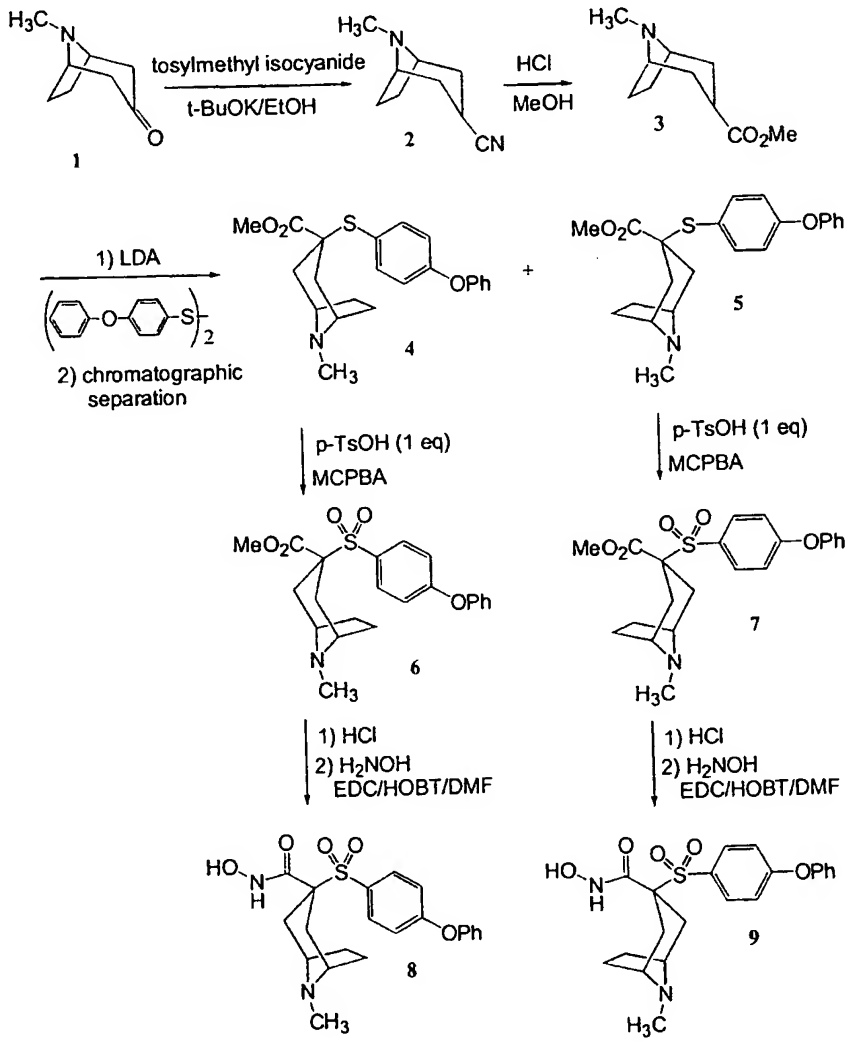
2

1) EDC,HOBT,DMF
H_2NOH



3

Scheme 18


tosylmethyl isocyanide
t-BuOK/EtOH
HCl
MeOH
1) LDA
2) chromatographic separation
p-TsOH (1 eq)
MCPBA
p-TsOH (1 eq)
MCPBA
1) HCl
2) H2NOH
EDC/HOBT/DMF
1) HCl
2) H2NOH
EDC/HOBT/DMF

Scheme 19

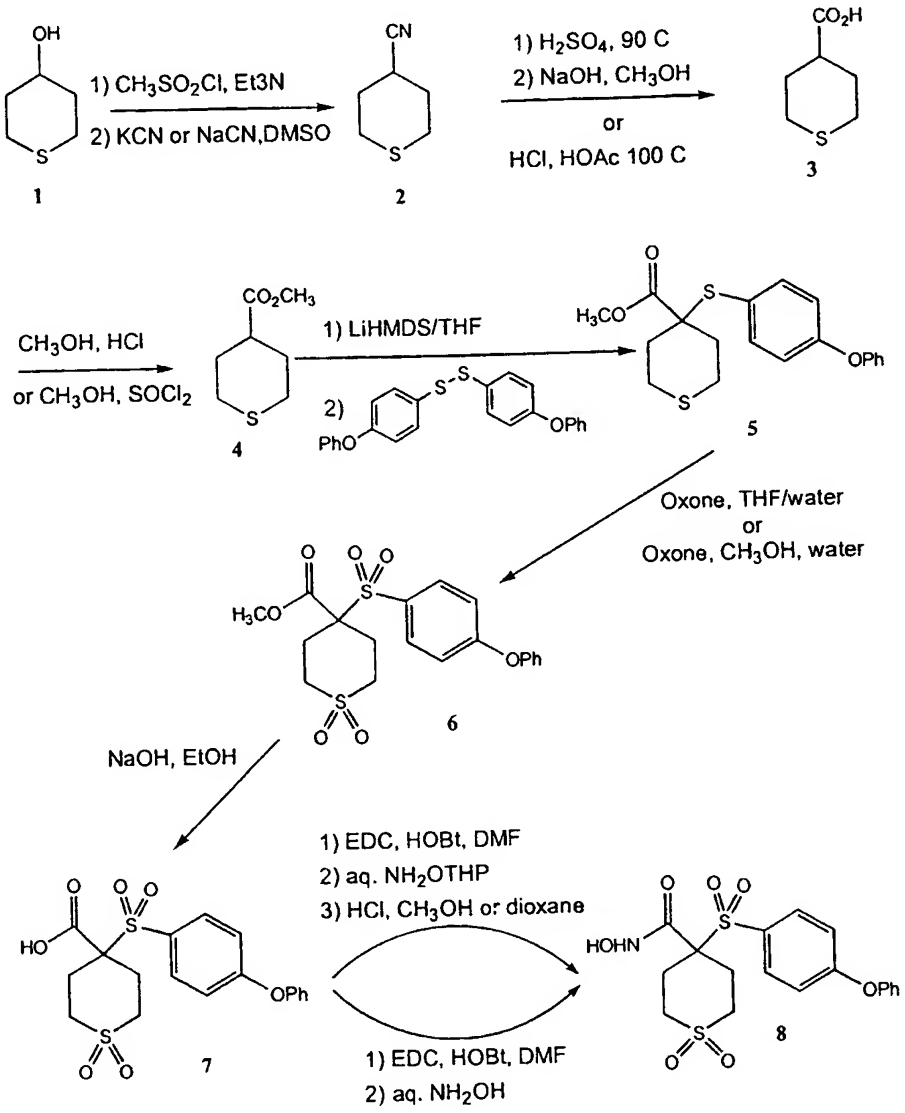
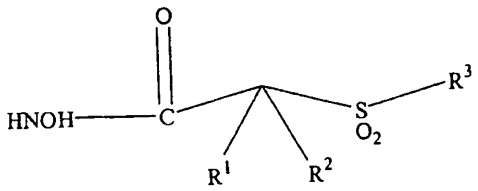
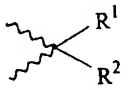


Table 1 through Table 150, below, show several contemplated aromatic sulfone hydroxamic acid inhibitor compounds or structural formulas that illustrate substituent groups. Each group of

compounds is illustrated by a generic formula, or formulae, followed by a series of preferred moieties or groups that constitute various substituents that can be attached at the position clearly shown in the generic structure. The substituent symbols, e.g., R1 and R2 and R3, are as shown in each Table, and are typically not those used before. One or two bonds (wavy lines) are shown with those substituents to indicate the respective positions of attachment in the illustrated compound. This system is well known in the chemical communication arts and is widely used in scientific papers and presentations. For example in Table 2, R1 and R2 together with the atoms to which they are bonded is the variable group with the structural entities that can substitute for R1 and R2 together shown in the balance of that table.

Table 1





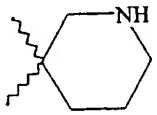
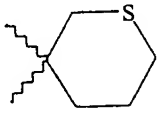
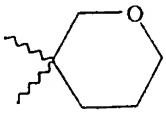
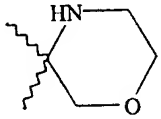
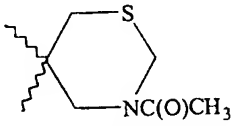
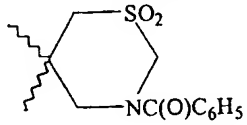
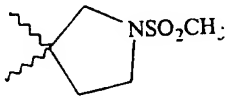
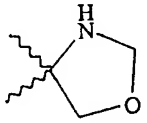
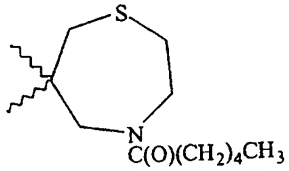
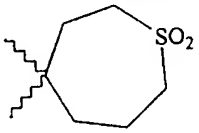
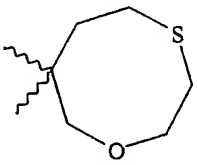
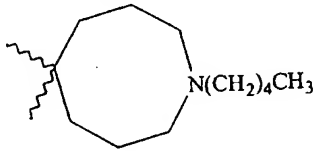
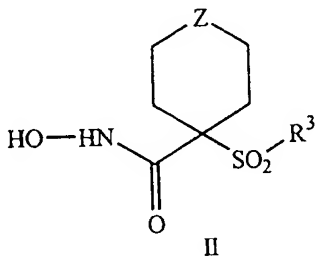
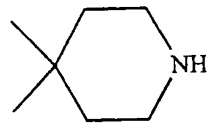
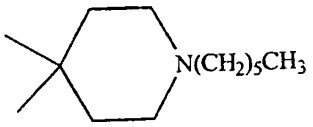
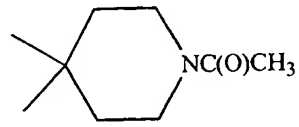
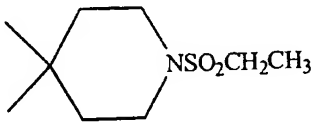
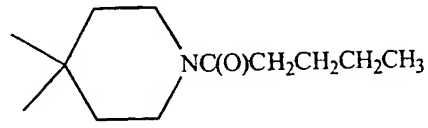
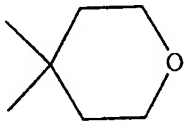
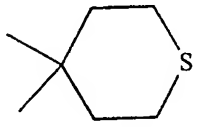
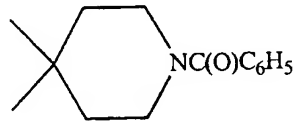
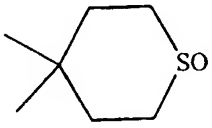
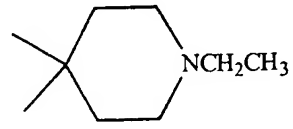
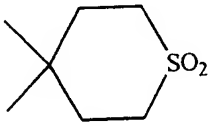
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Table 2



II

1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

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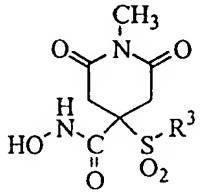
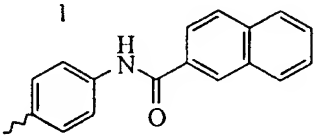
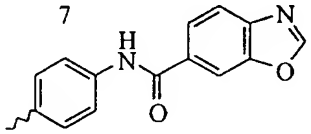
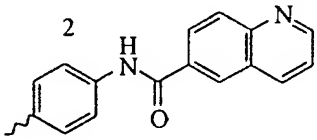
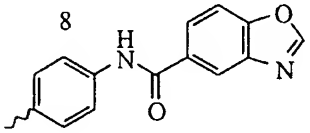
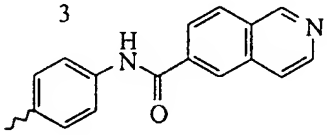
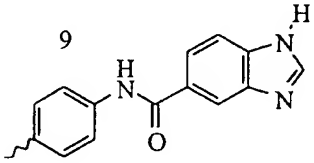
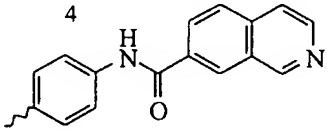
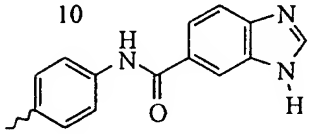
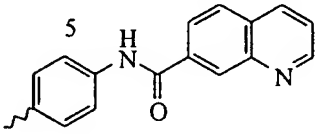
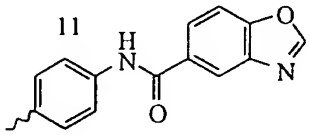
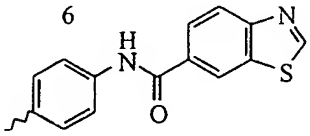
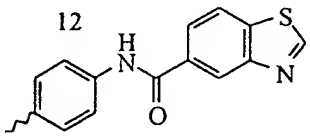
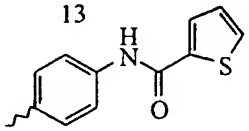
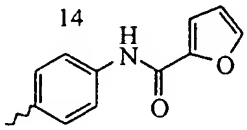
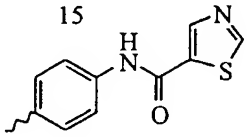
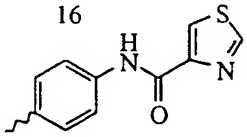
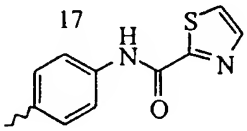
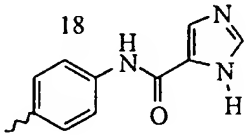


1 	7 
2 	8 
3 	9 
4 	10 
5 	11 
6 	12 

13 	
14 	
15 	
16 	
17 	
18 	

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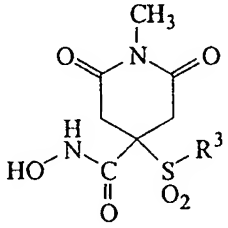
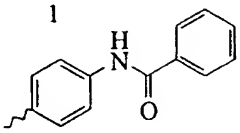
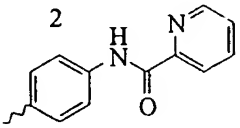
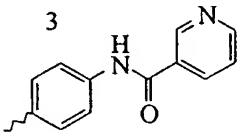
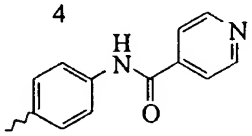
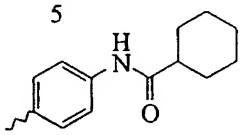
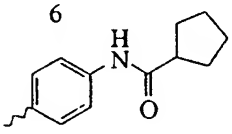
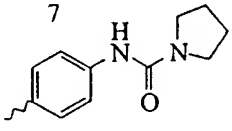
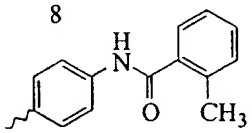
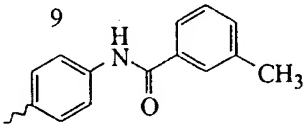
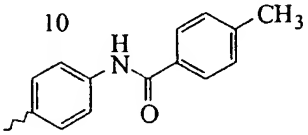
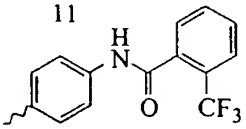
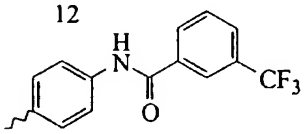
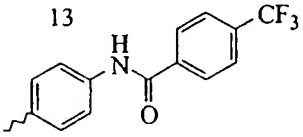
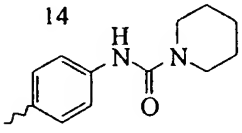
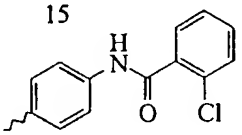
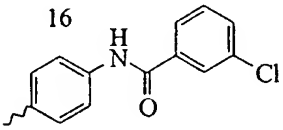
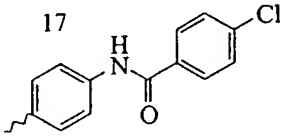
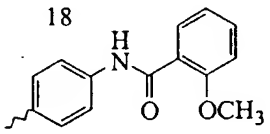
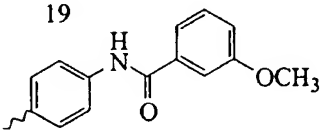
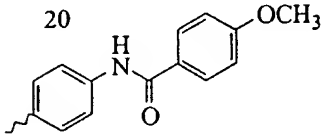
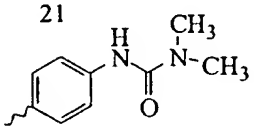


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

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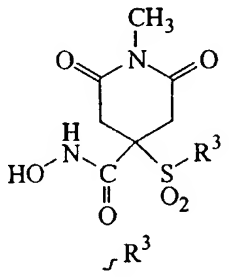
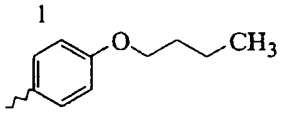
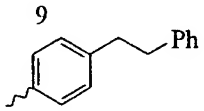
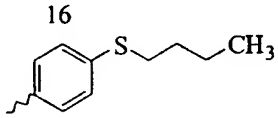
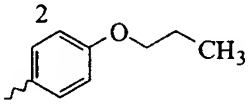
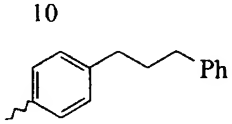
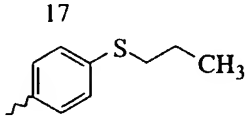
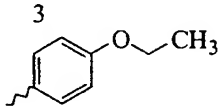
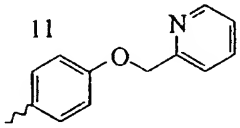
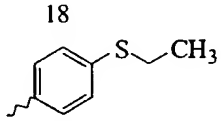
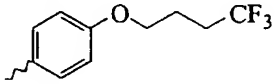
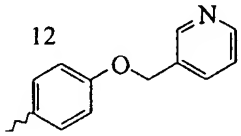
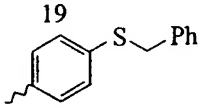
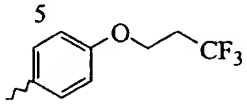
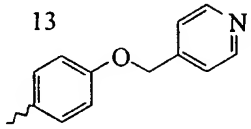
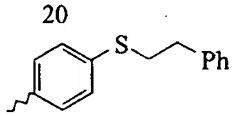
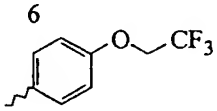
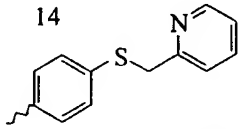
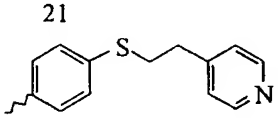
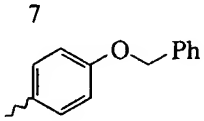
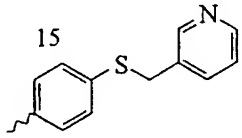
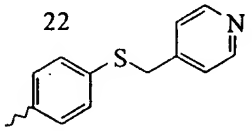
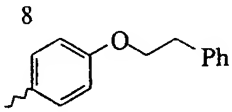


1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

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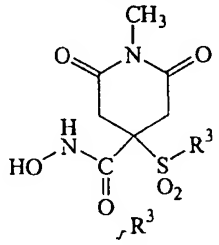

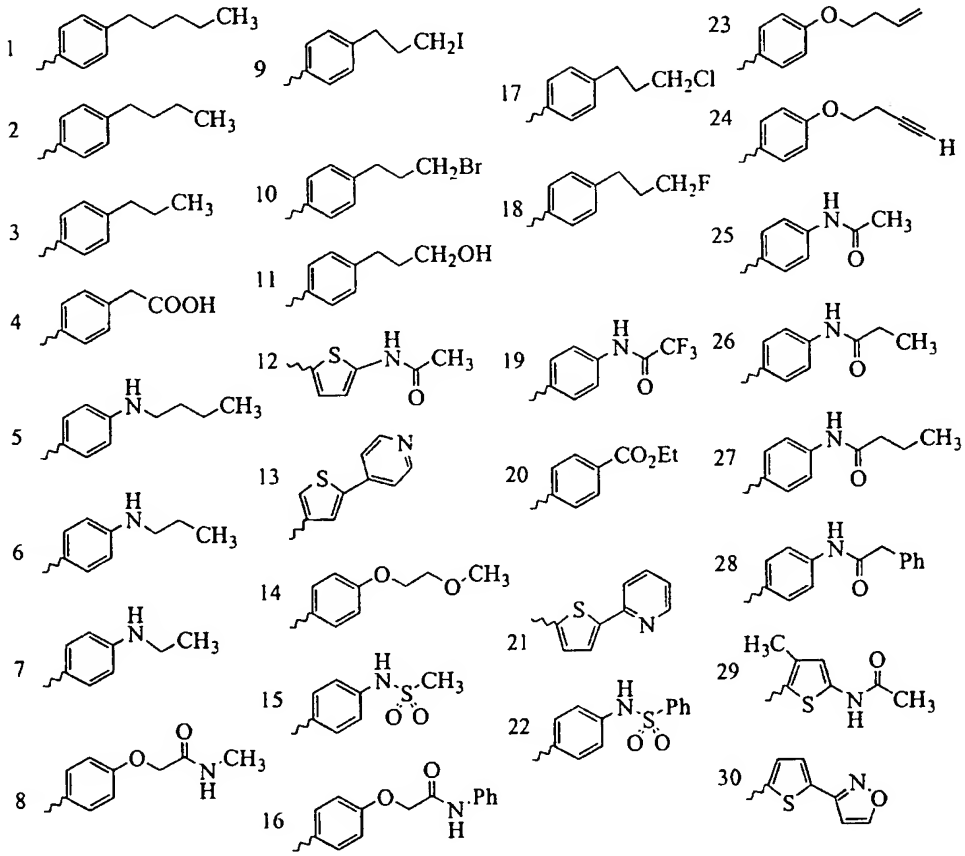
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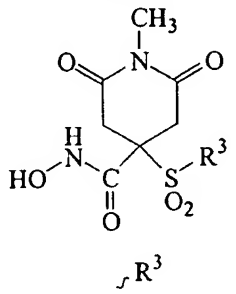
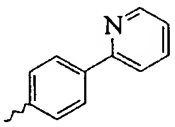
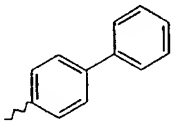
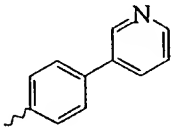
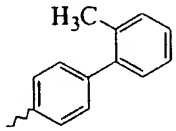
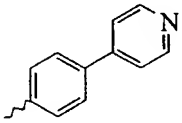
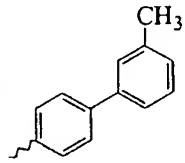
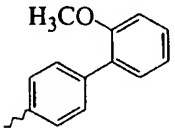
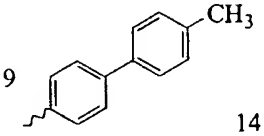
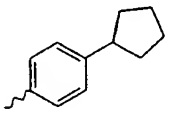
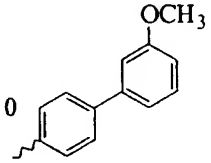
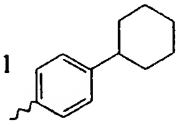
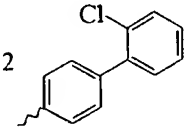
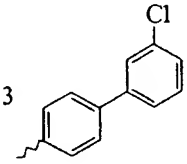
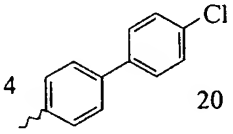
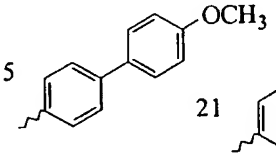
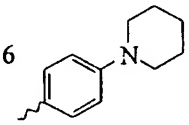
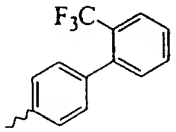
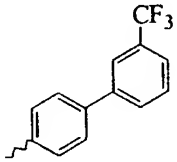
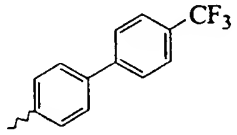
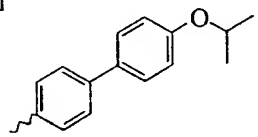
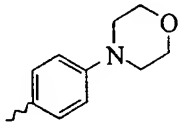
Table 7



1		6	
2		7	
3		8	
4		9	
5		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	
		21	

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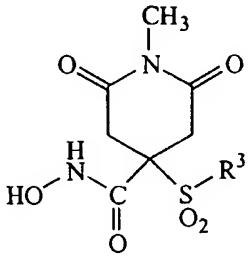
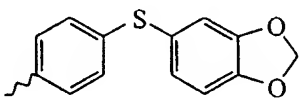
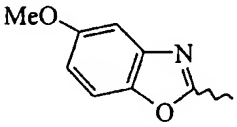
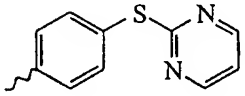
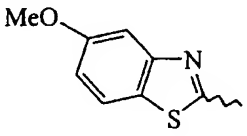
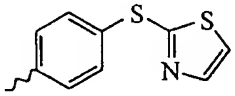
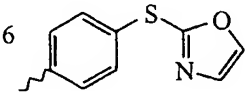
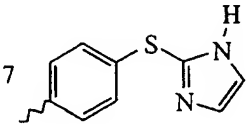
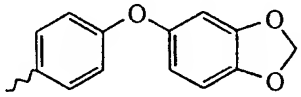
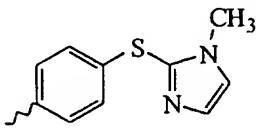
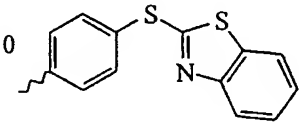
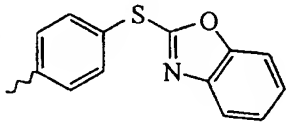


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

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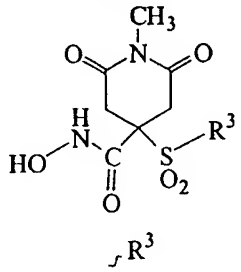
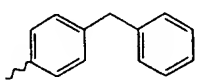
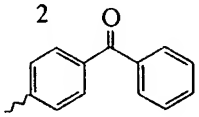
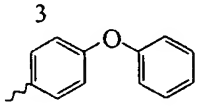
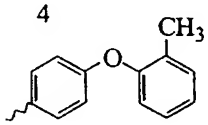
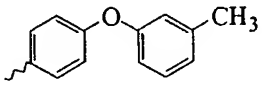
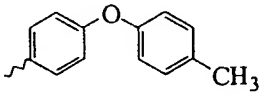
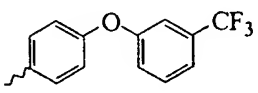
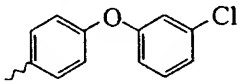
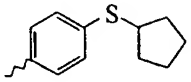
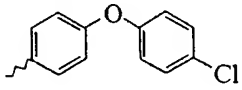
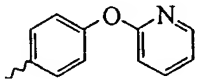
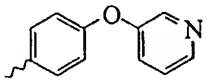
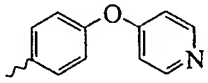
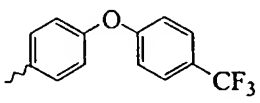
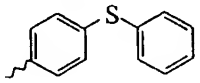
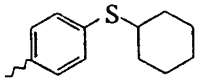
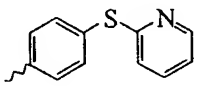
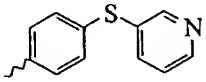
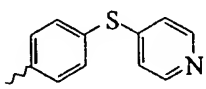
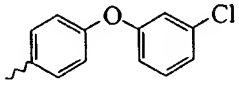
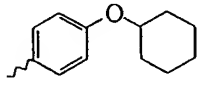


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

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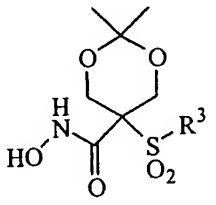

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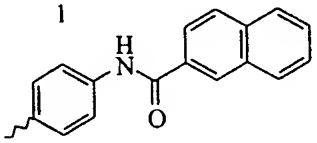
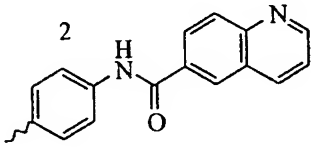
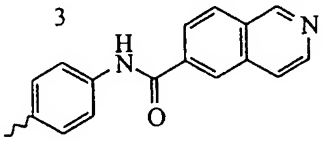
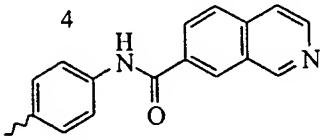
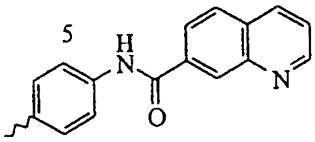
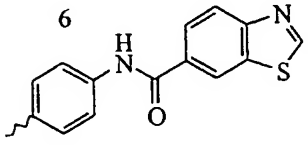
1 

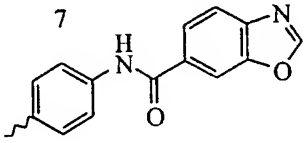
2 

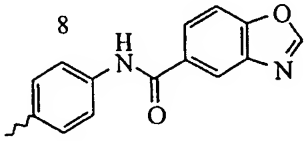
3 

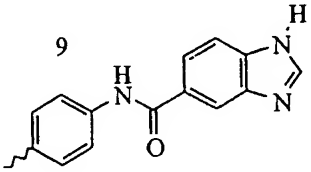
4 

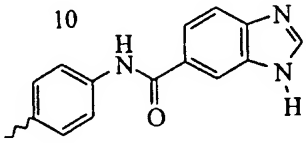
5 

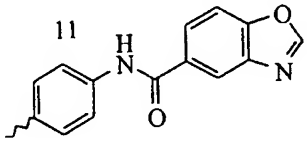
6 

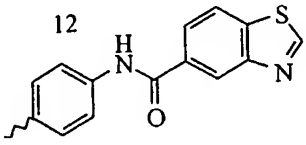
7 

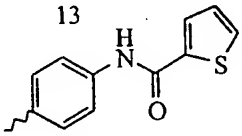
8 

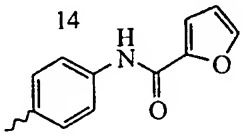
9 

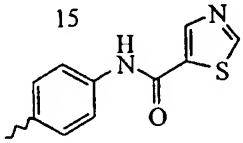
10 

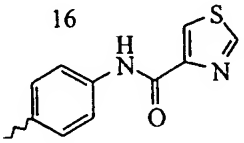
11 

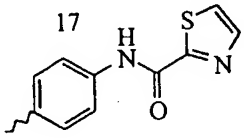
12 

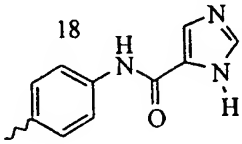
13 

14 

15 

16 

17 

18 

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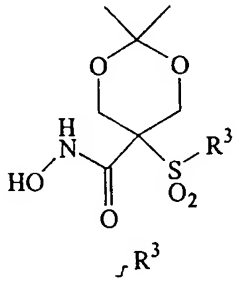
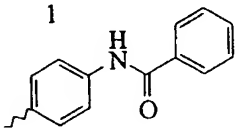
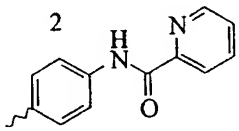
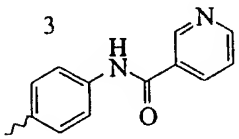
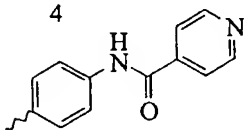
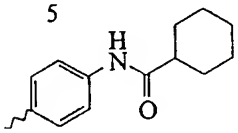
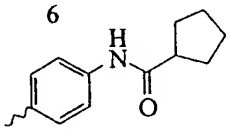
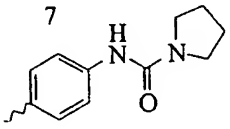
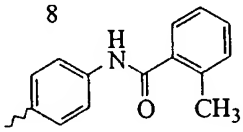
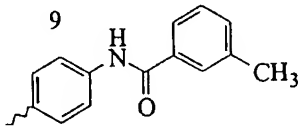
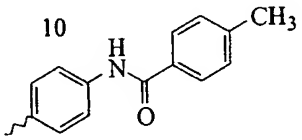
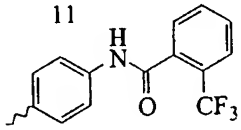
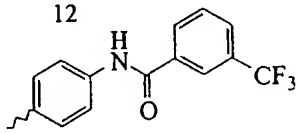
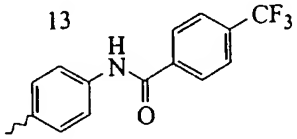
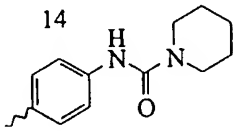
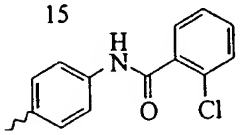
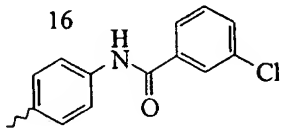
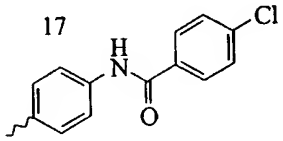
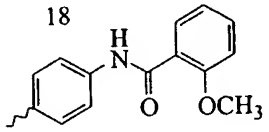
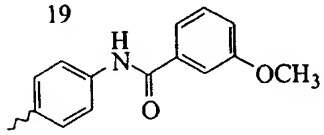
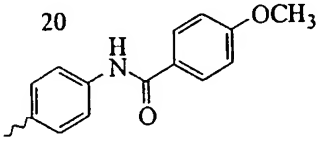
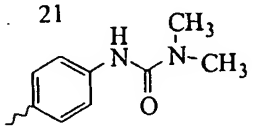


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

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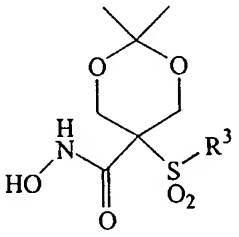
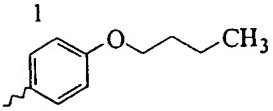
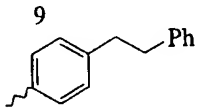
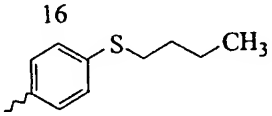
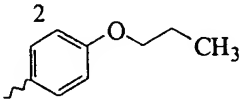
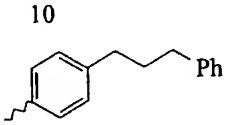
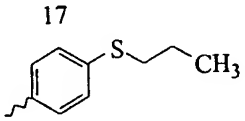
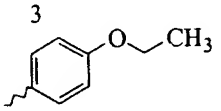
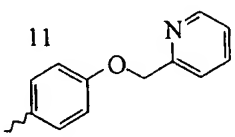
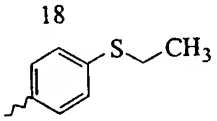
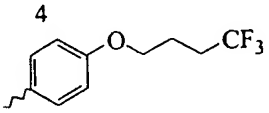
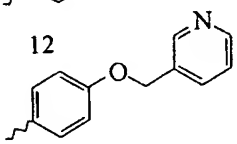
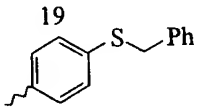
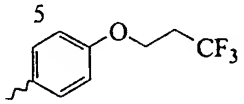
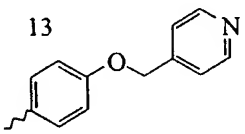
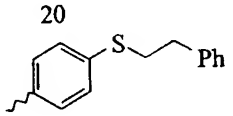
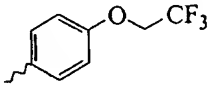
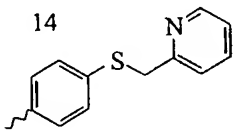
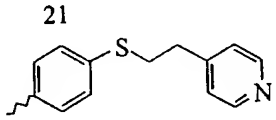
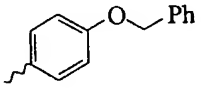
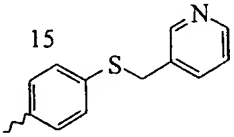
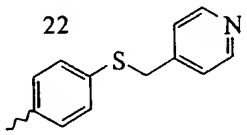
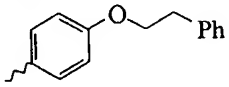


1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

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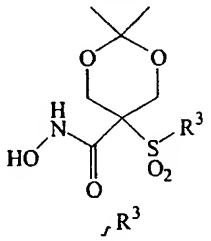

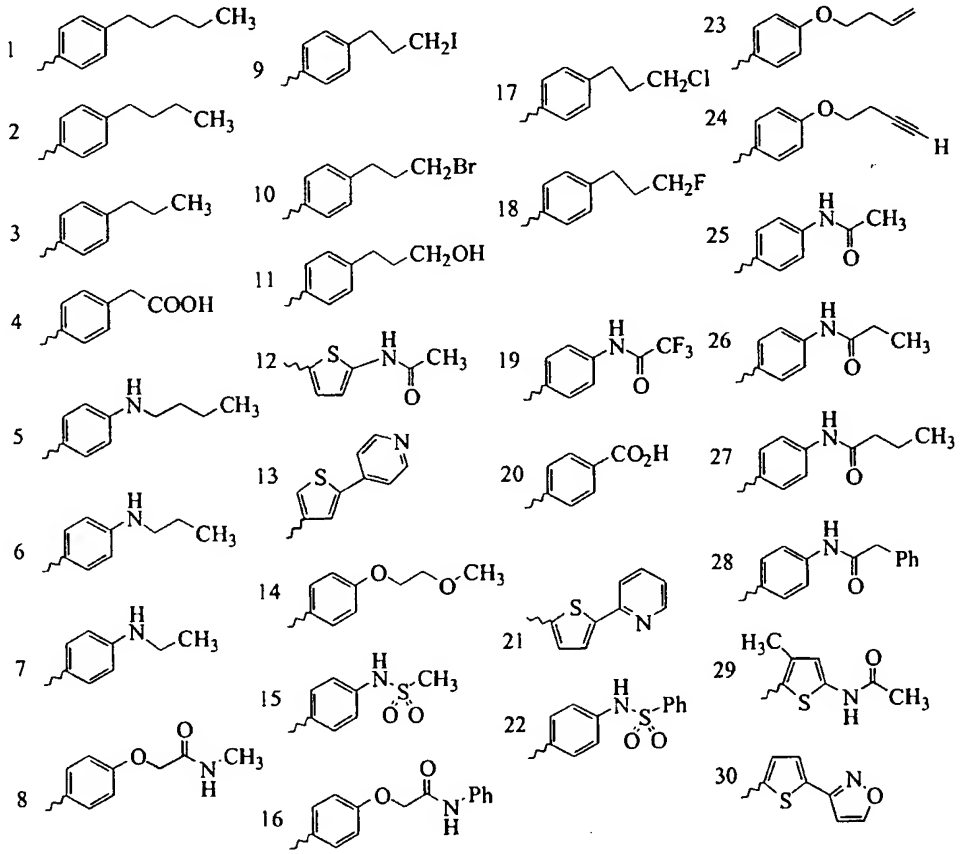
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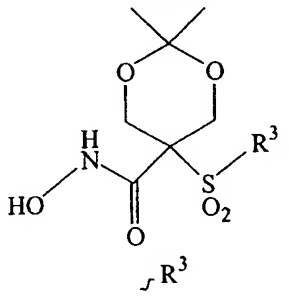
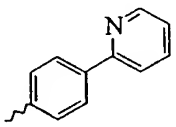
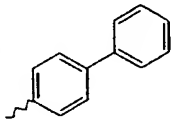
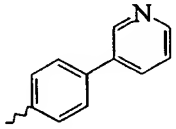
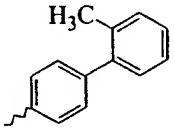
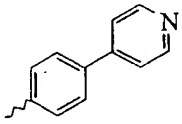
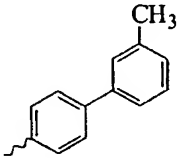
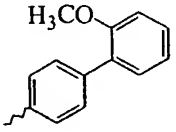
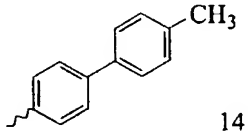
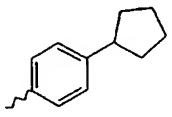
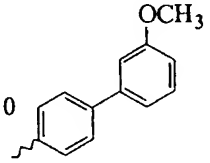
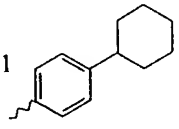
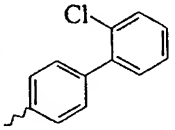
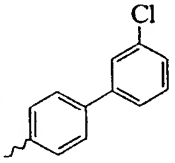
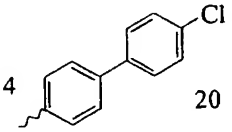
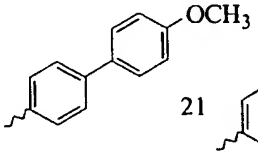
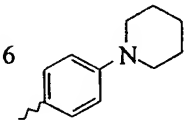
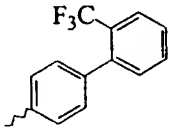
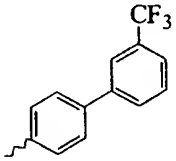
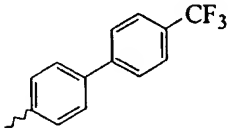
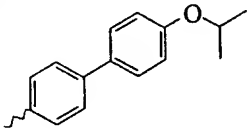
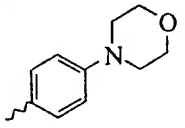
Table 14



1		6	
2		7	
3		8	
4		9	
5		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	
		21	

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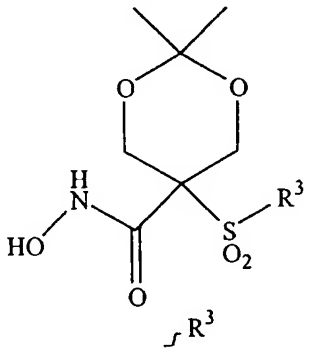
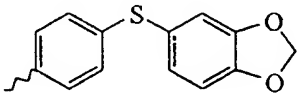
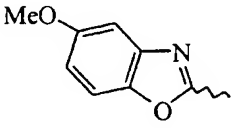
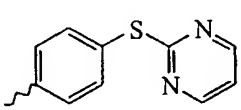
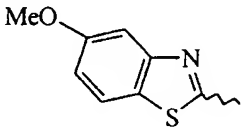
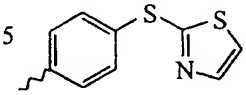
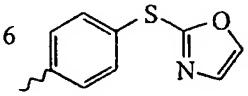
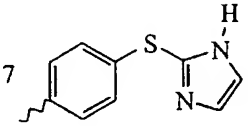
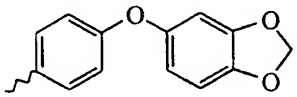
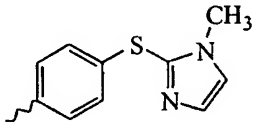
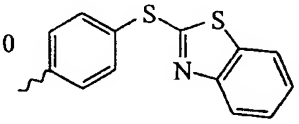
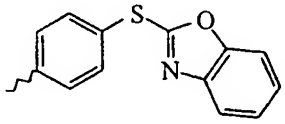


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

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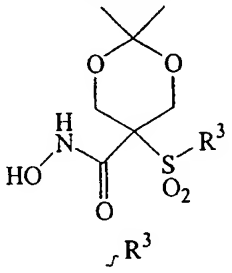
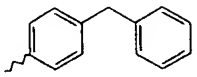
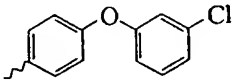
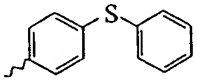
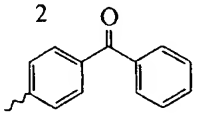
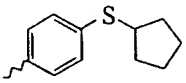
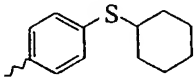
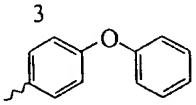
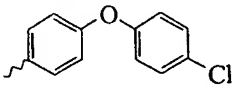
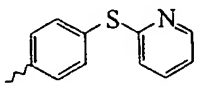
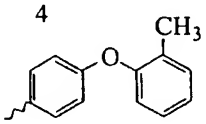
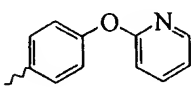
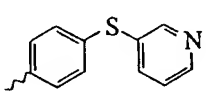
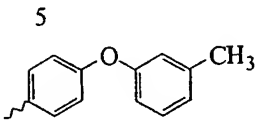
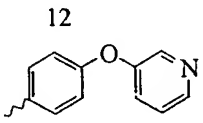
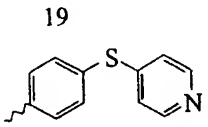
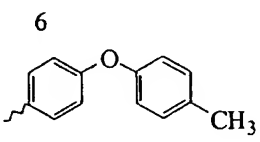
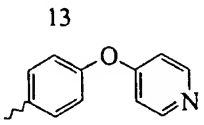
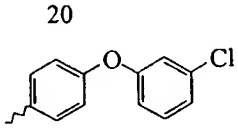
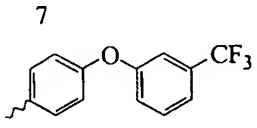
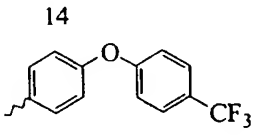
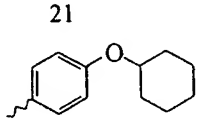


1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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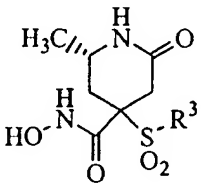
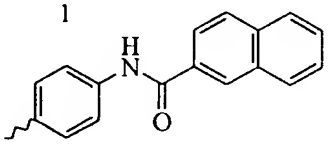
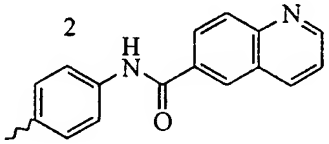
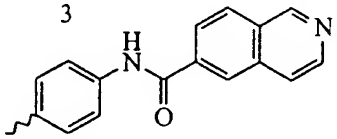
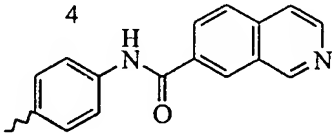
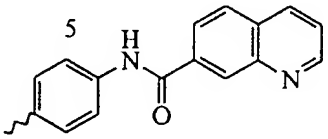
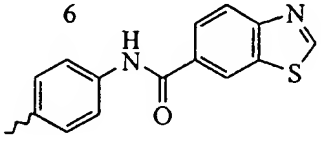
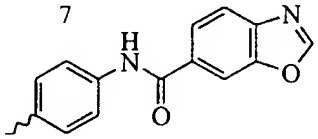
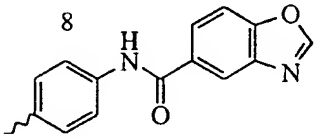
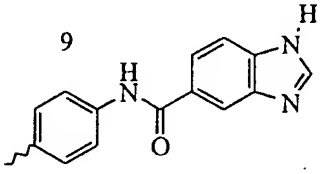
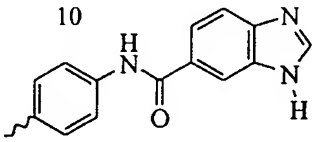
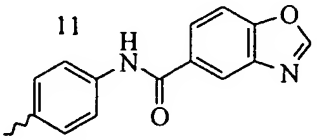
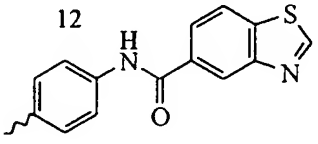
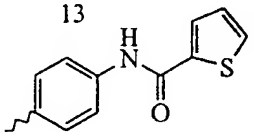
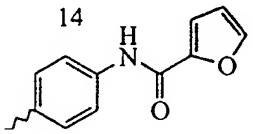
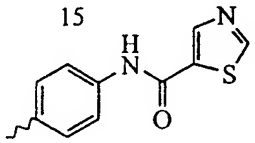
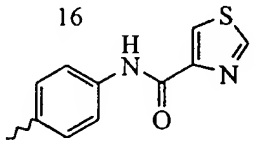
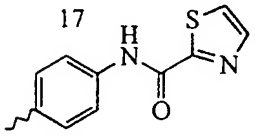
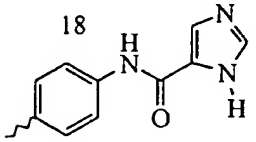


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	

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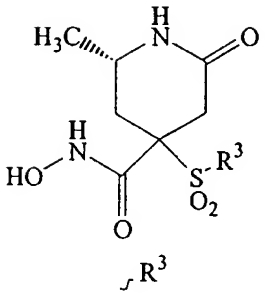
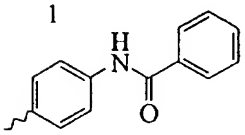
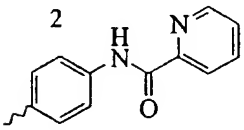
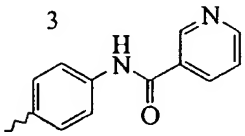
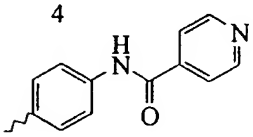
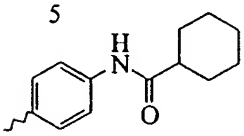
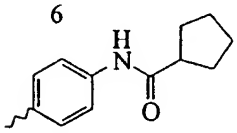
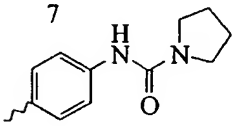
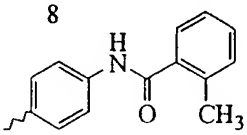
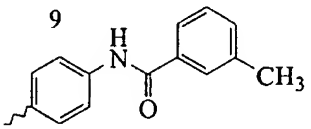
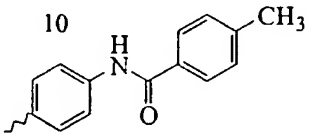
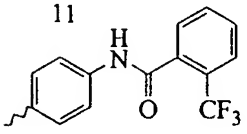
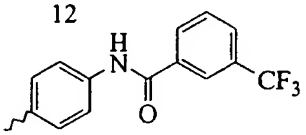
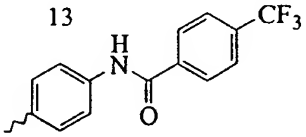
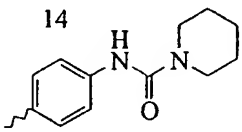
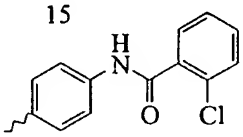
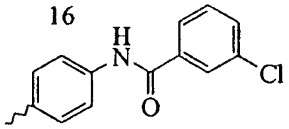
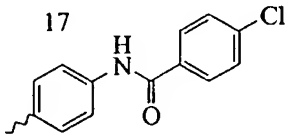
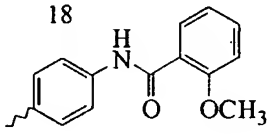
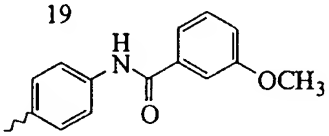
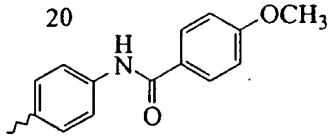
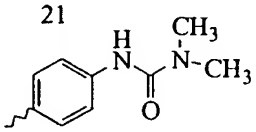


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

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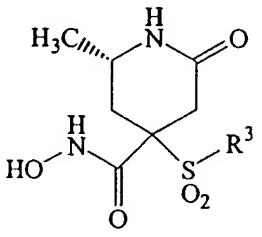
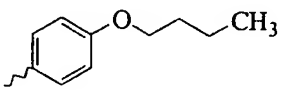
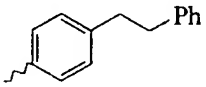
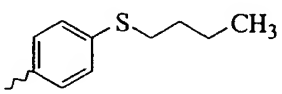
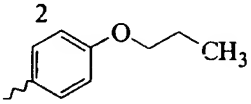
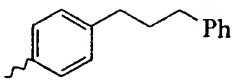
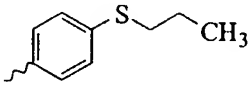
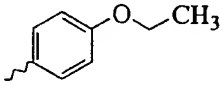
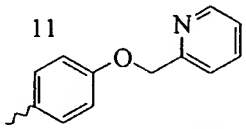
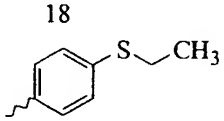
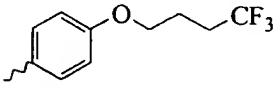
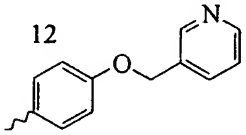
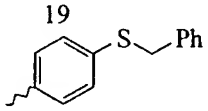
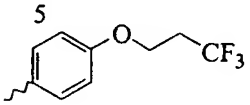
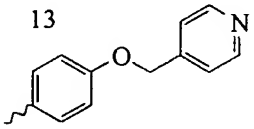
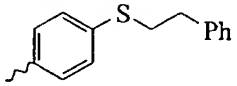
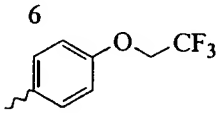
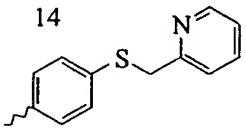
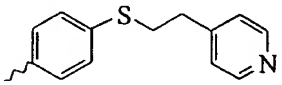
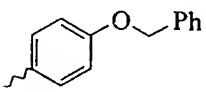
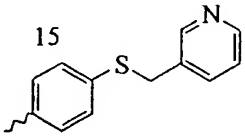
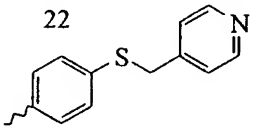
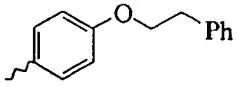


1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

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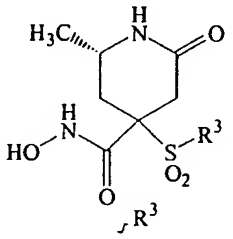

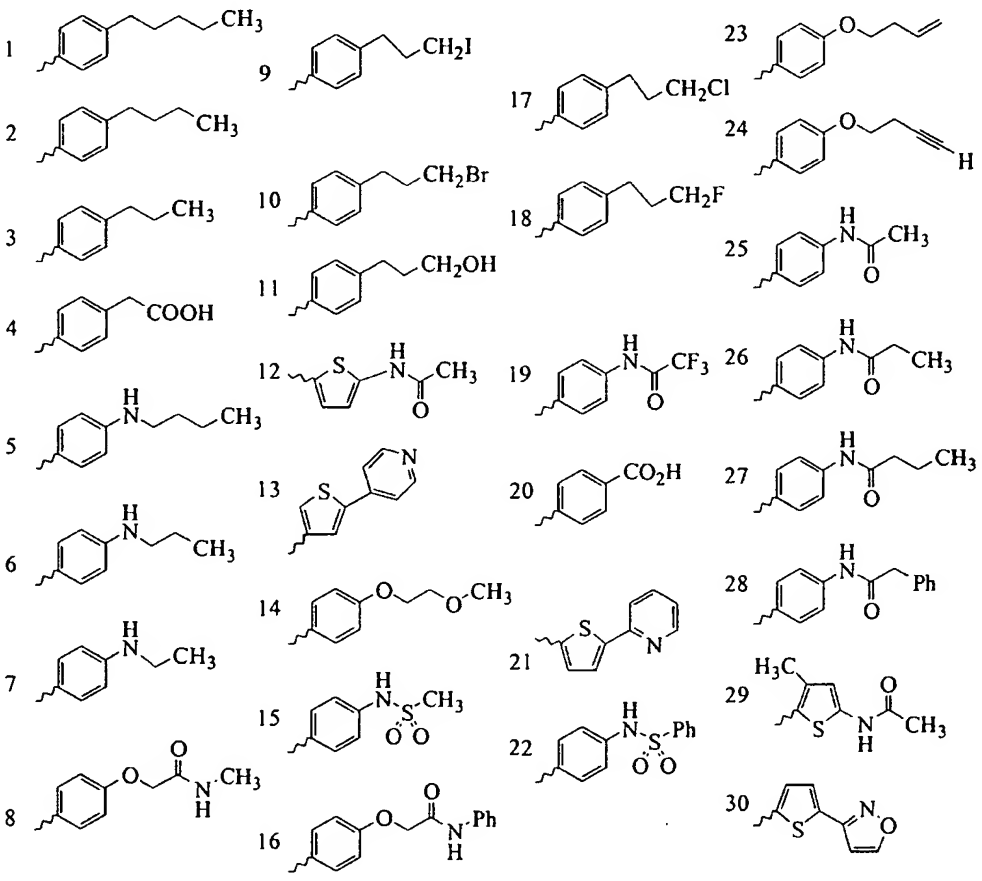
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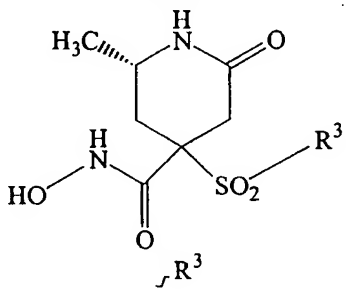
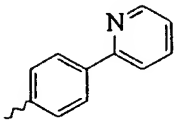
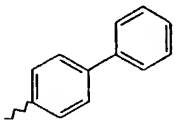
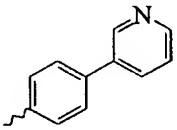
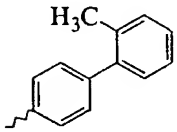
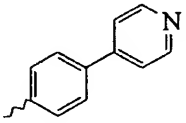
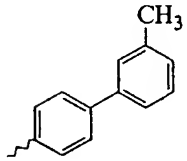
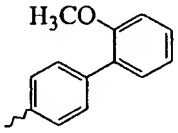
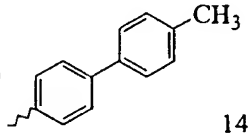
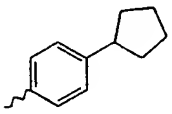
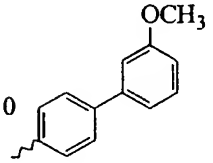
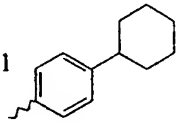
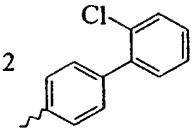
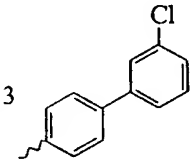
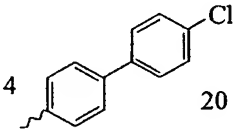
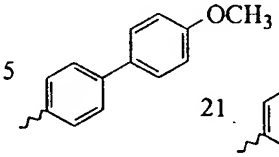
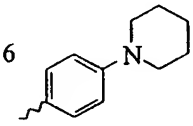
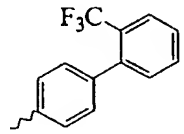
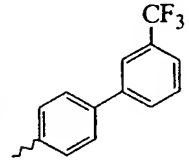
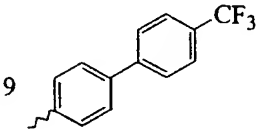
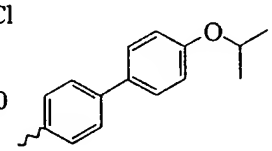
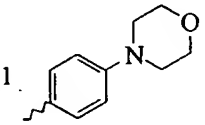
Table 21



1		6	
2		7	
3		8	
4		9	
5		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	
		21	

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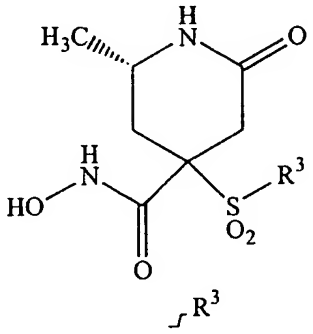

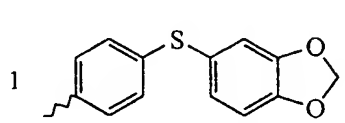

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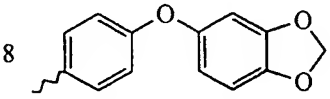

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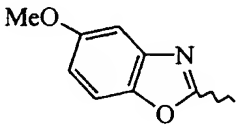

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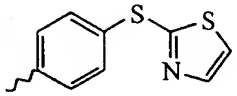

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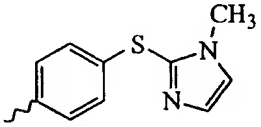

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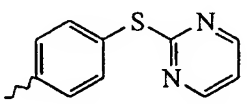

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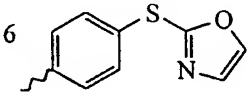

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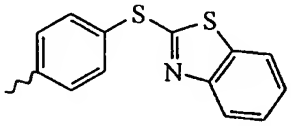

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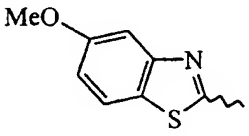

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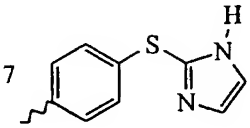

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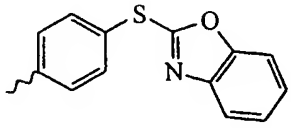

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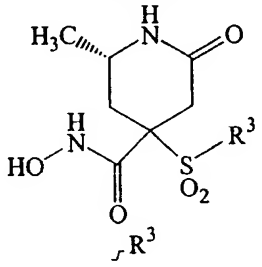
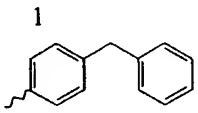
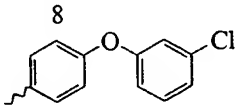
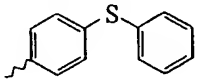
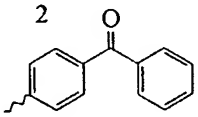
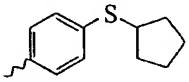
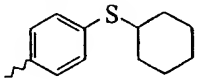
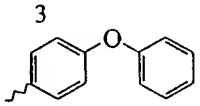
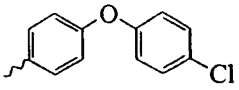
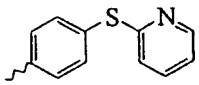
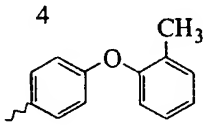
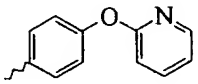
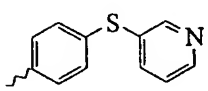
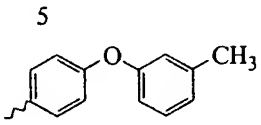
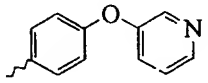
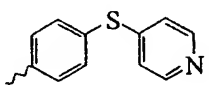
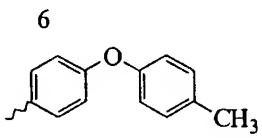
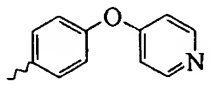
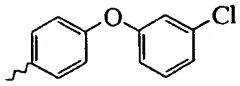
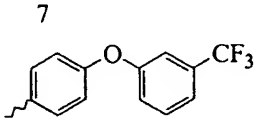
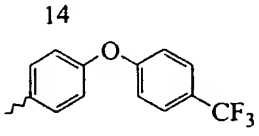
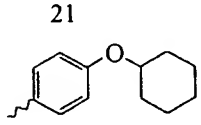


1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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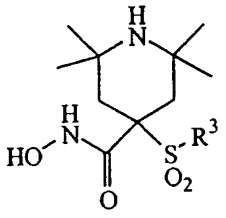
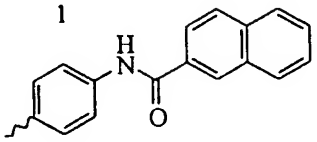
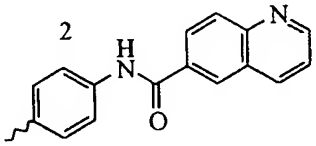
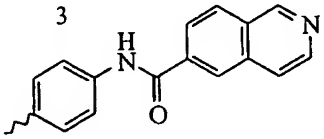
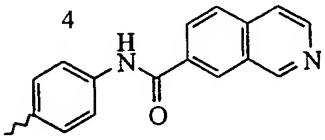
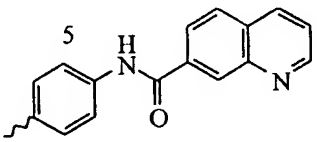
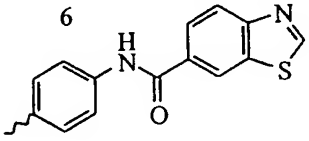
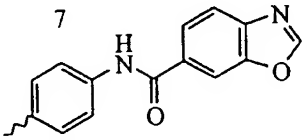
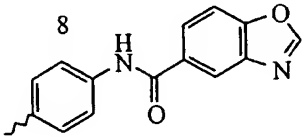
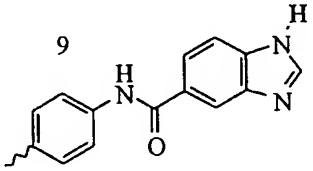
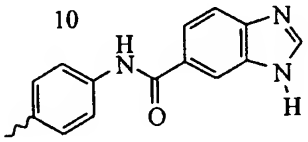
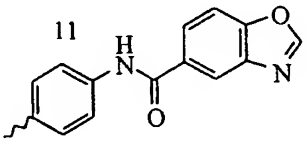
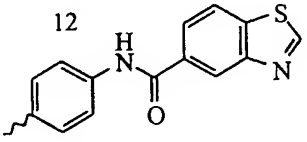
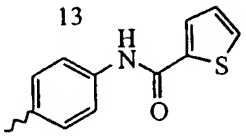
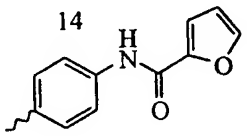
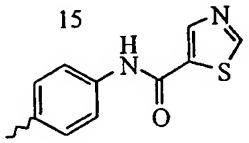
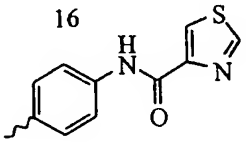
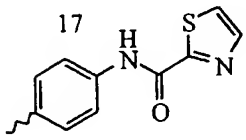
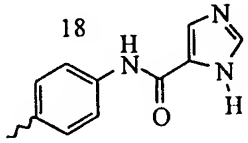


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	

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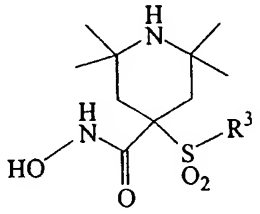

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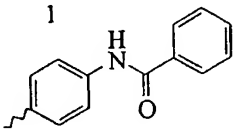
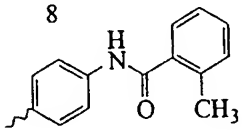
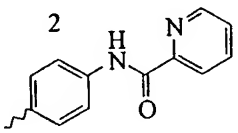
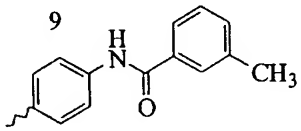
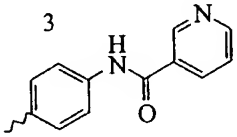
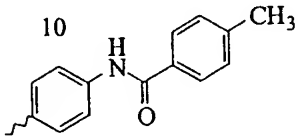
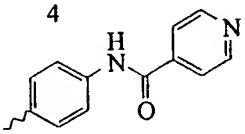
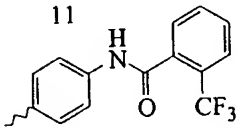
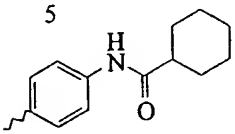
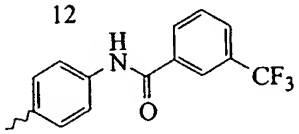
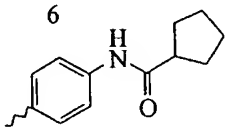
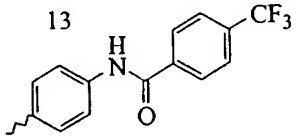
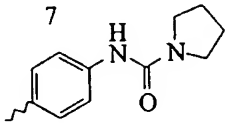
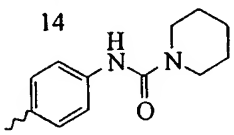
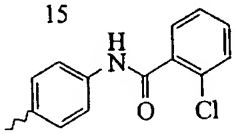
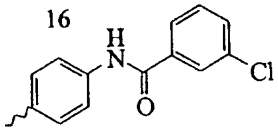
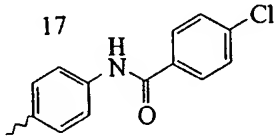
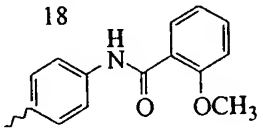
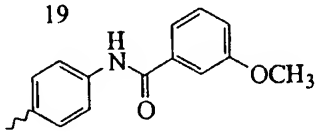
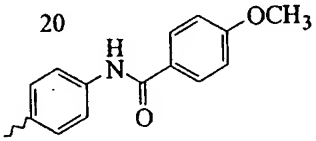
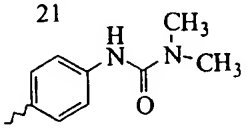
1 	8 
2 	9 
3 	10 
4 	11 
5 	12 
6 	13 
7 	14 
	15 
	16 
	17 
	18 
	19 
	20 
	21 

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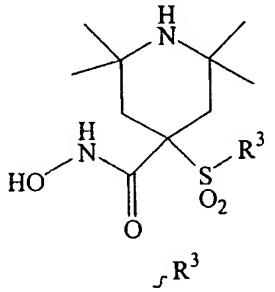
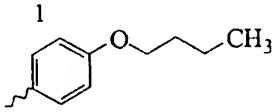
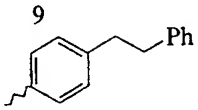
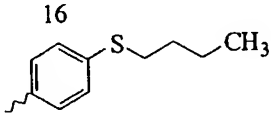
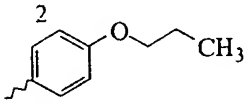
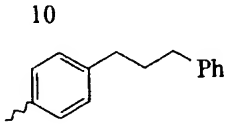
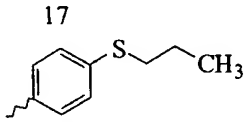
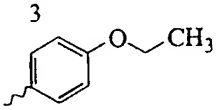
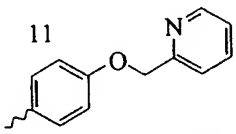
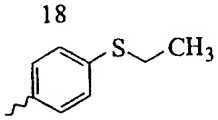
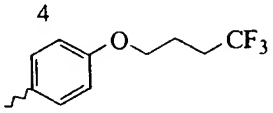
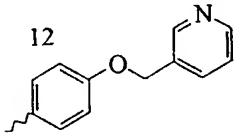
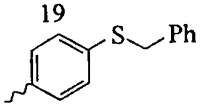
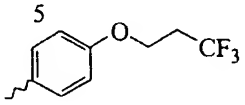
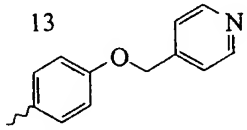
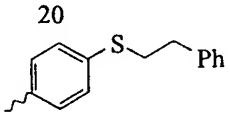
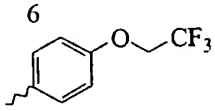
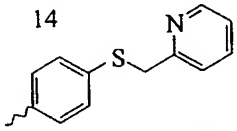
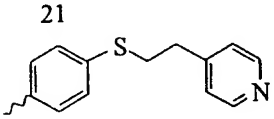
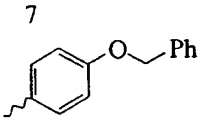
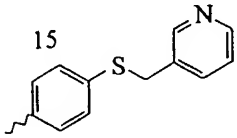
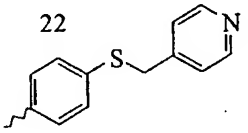
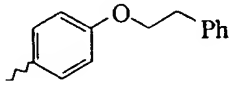


1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

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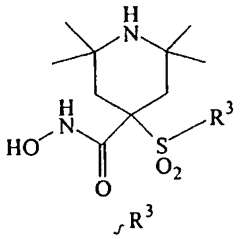

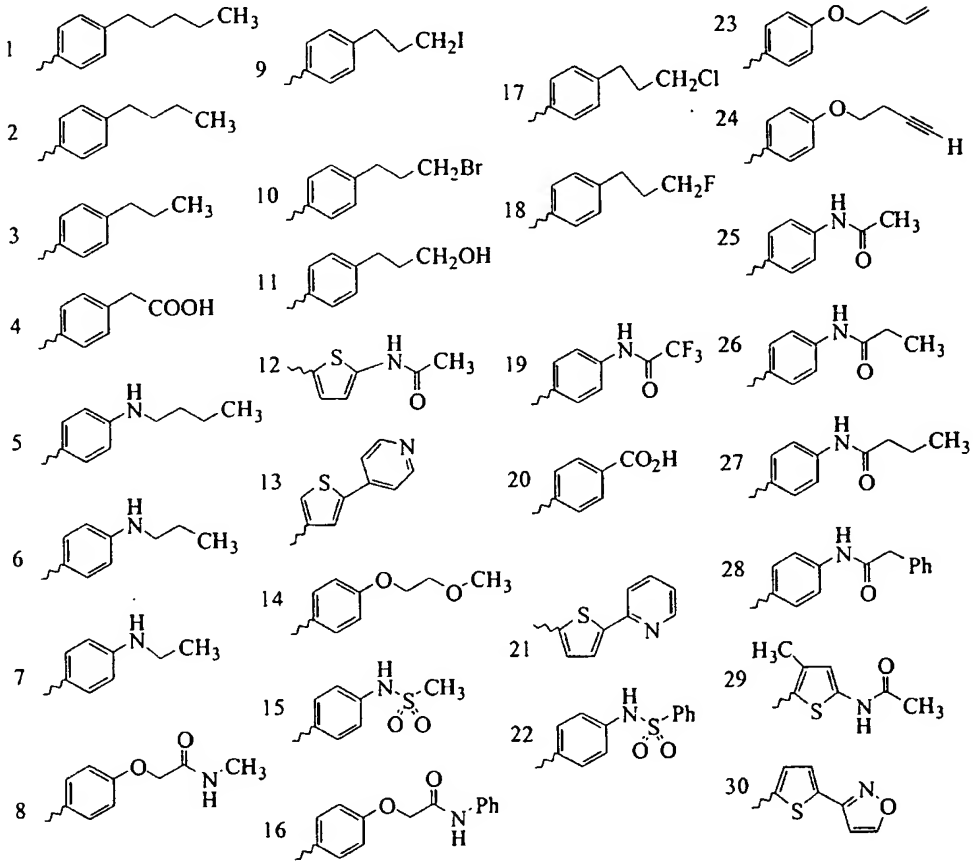
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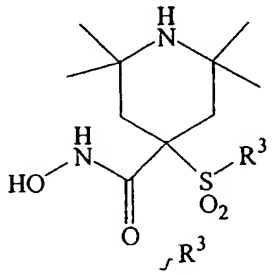
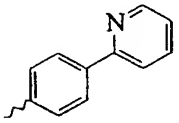
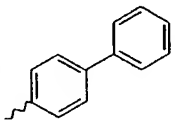
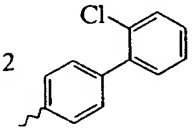
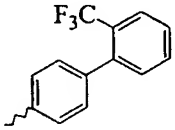
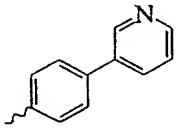
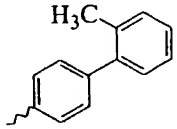
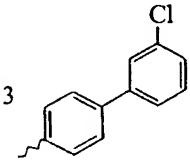
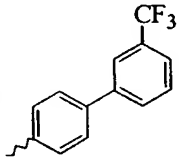
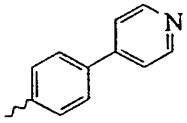
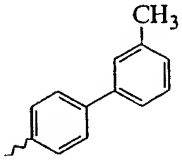
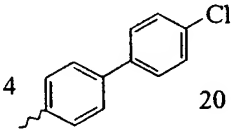
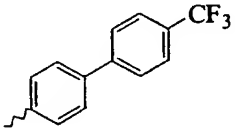
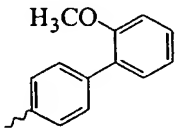
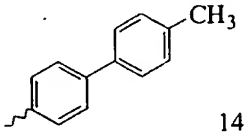
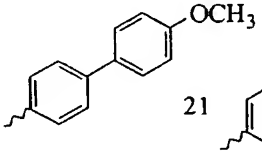
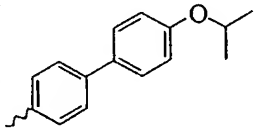
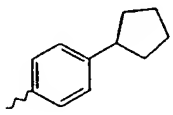
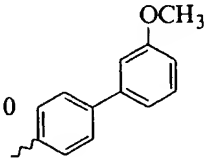
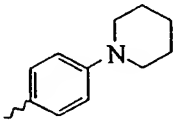
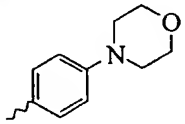
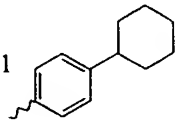
Table 28



1 	6 	12 	17 
2 	7 	13 	18 
3 	8 	14 	19 
4 	9 	15 	20 
5 	10 	16 	21 
	11 		

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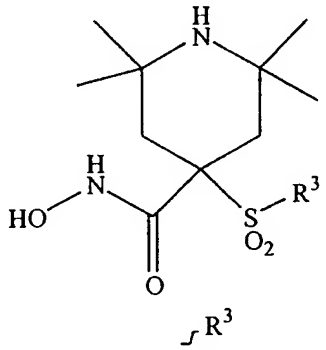
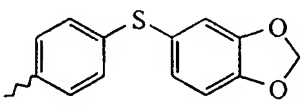
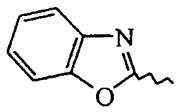
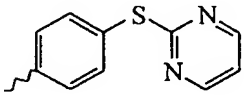
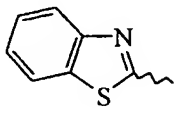
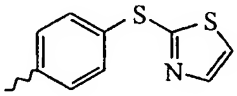
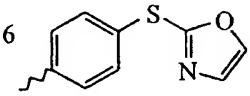
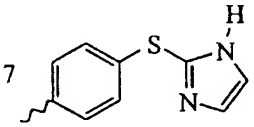
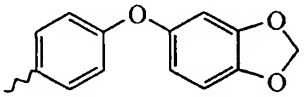
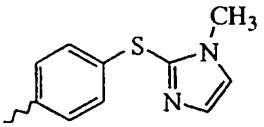
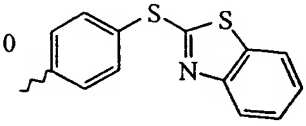
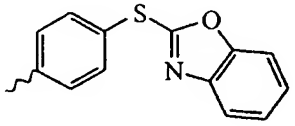


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

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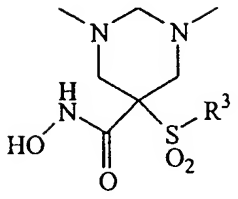
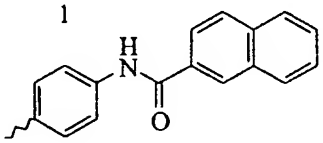
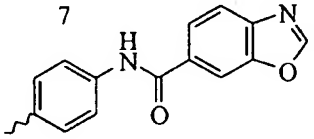
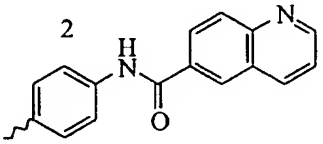
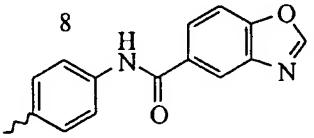
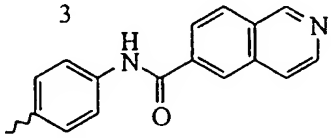
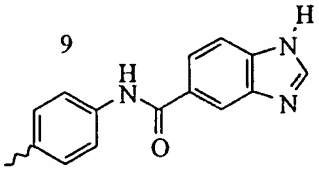
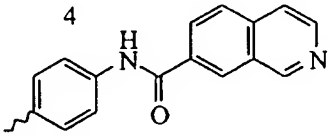
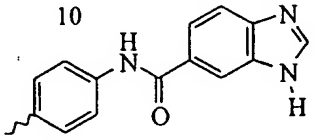
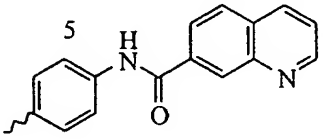
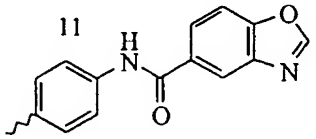
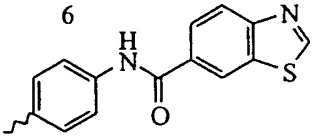
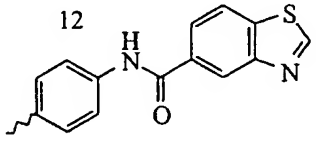
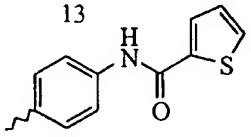
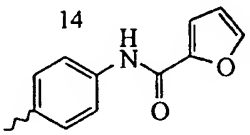
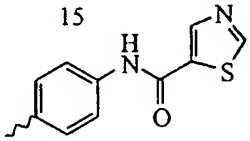
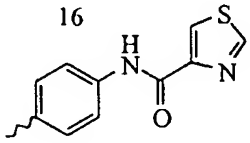
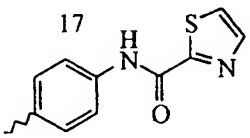
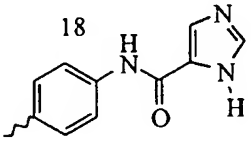


1 	7 
2 	8 
3 	9 
4 	10 
5 	11 
6 	12 

13 	
14 	
15 	
16 	
17 	
18 	

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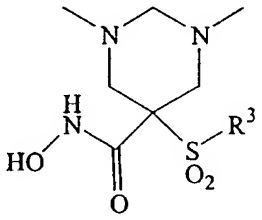

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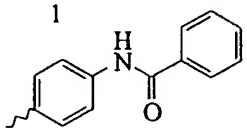
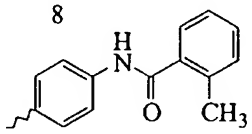
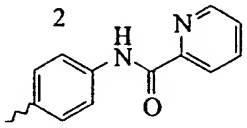
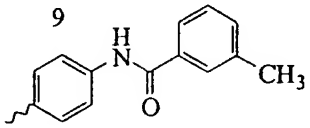
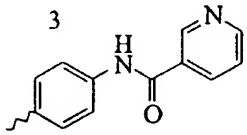
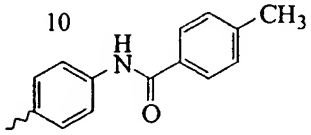
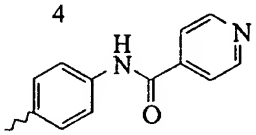
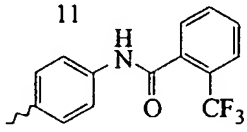
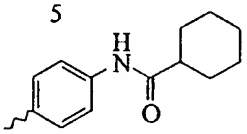
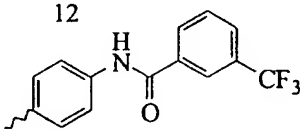
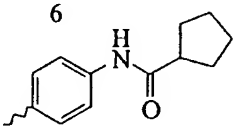
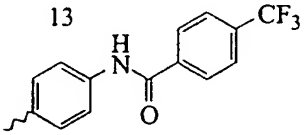
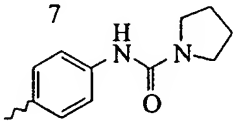
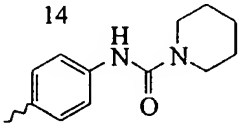
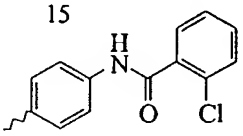
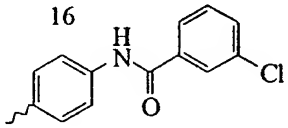
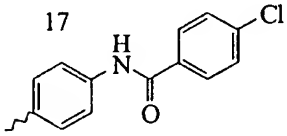
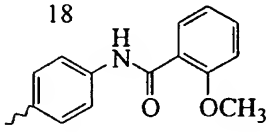
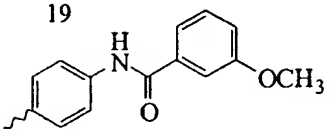
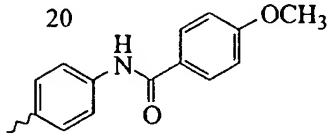
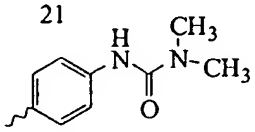
1 	8 
2 	9 
3 	10 
4 	11 
5 	12 
6 	13 
7 	14 

15 
16 
17 
18 
19 
20 
21 

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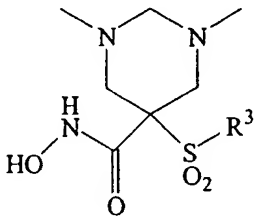

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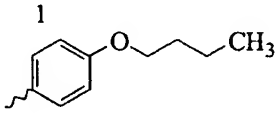
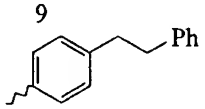
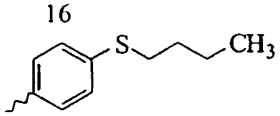
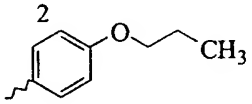
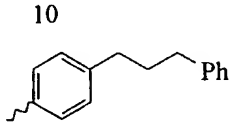
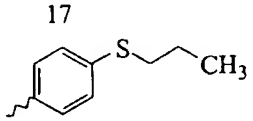
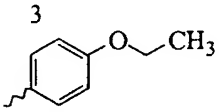
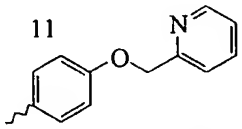
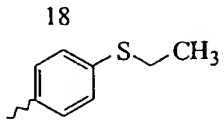
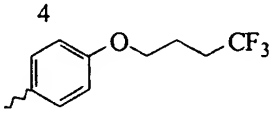
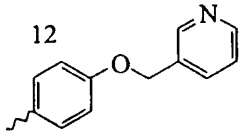
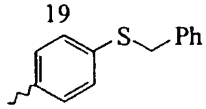
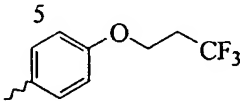
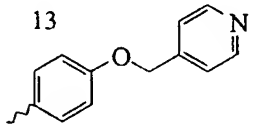
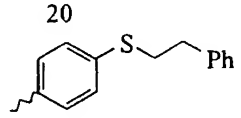
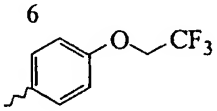
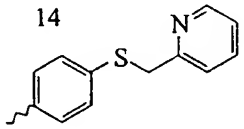
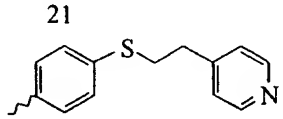
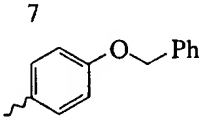
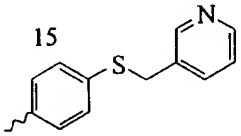
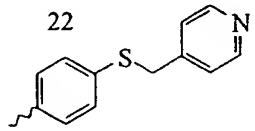
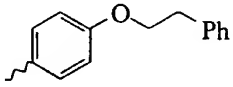
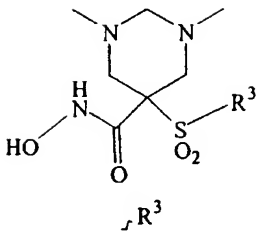
1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

Table 33



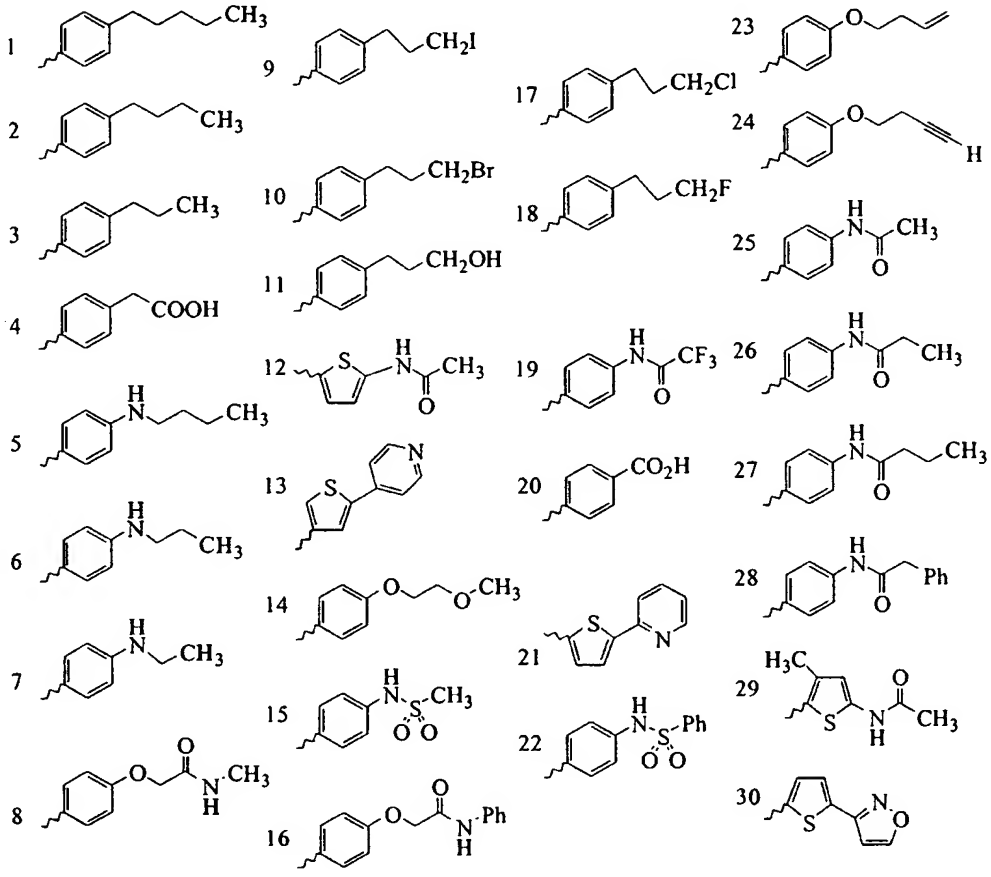

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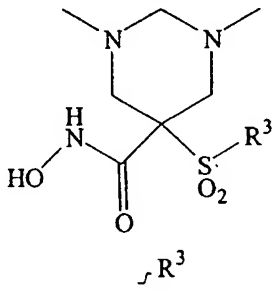
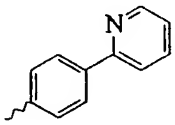
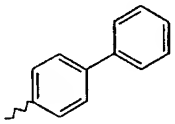
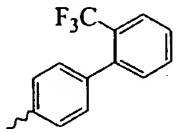
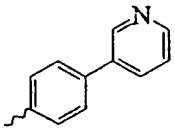
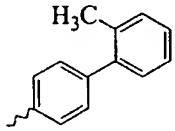
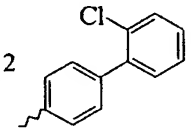
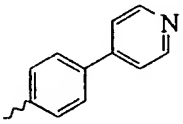
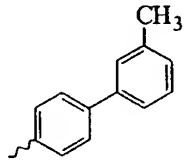
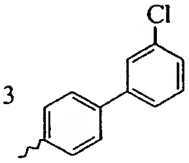
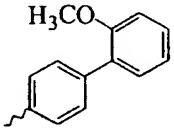
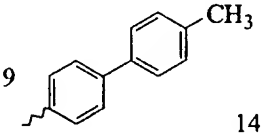
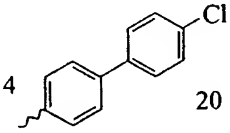
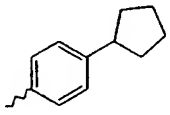
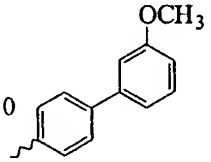
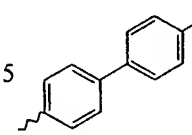
Table 34



1			
2			
3			
4			
5			
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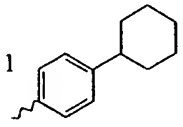
11			
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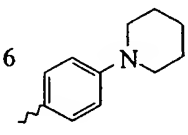
16			
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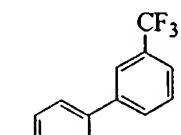
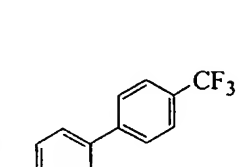
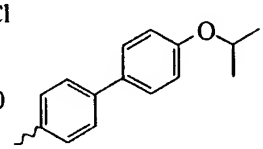
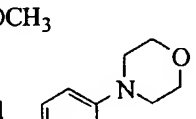
18			
19			
20			
21			

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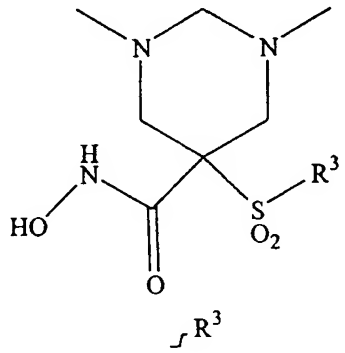
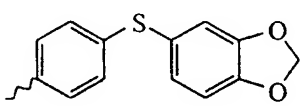
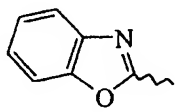
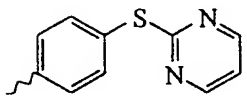
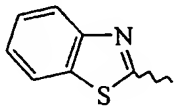
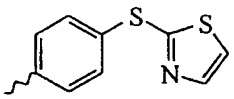
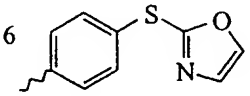
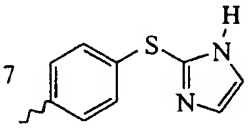
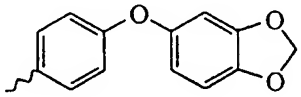
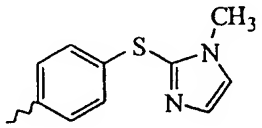
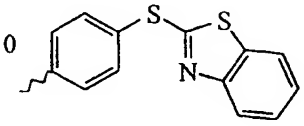
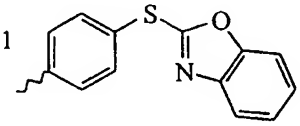


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

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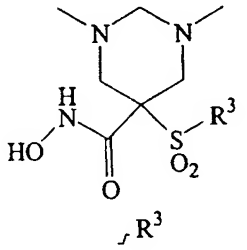
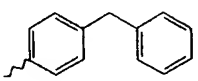
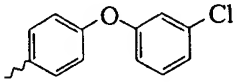
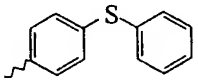
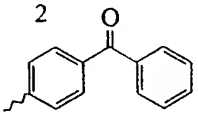
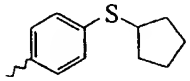
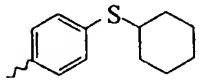
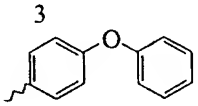
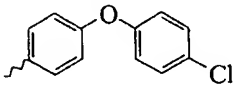
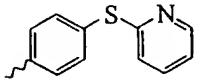
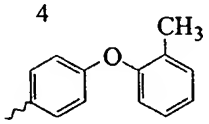
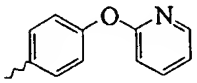
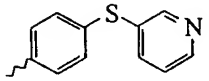
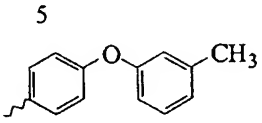
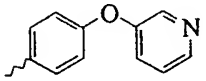
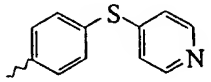
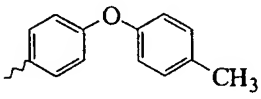
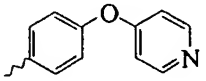
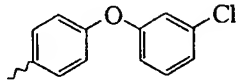
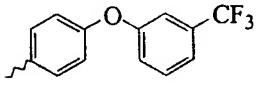
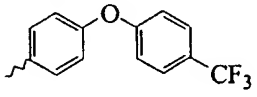
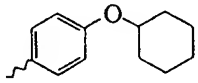


1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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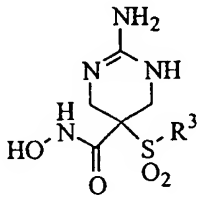
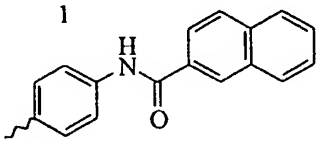
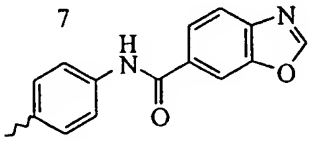
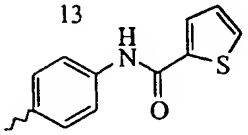
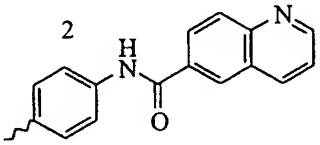
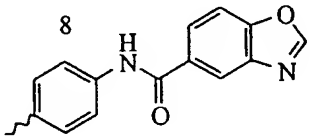
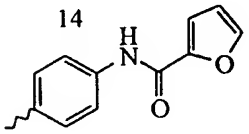
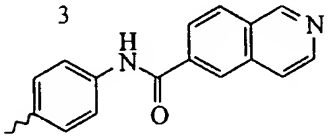
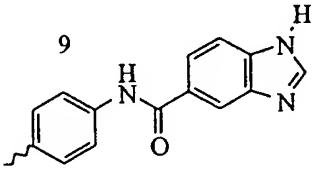
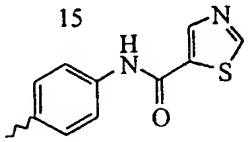
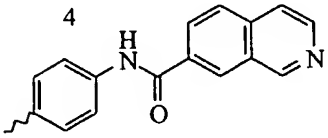
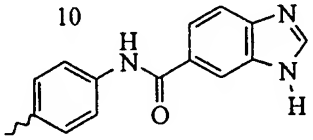
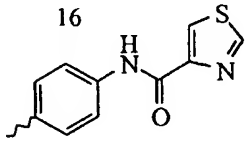
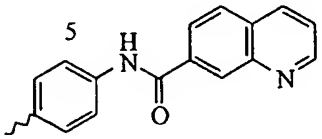
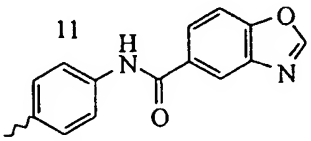
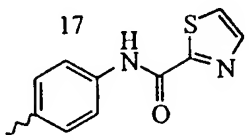
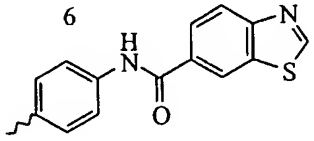
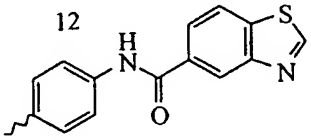
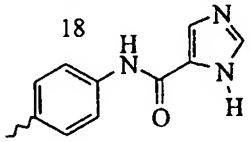


1 	7 	13 
2 	8 	14 
3 	9 	15 
4 	10 	16 
5 	11 	17 
6 	12 	18 

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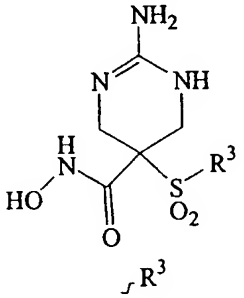
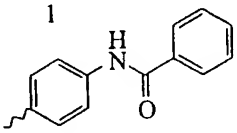
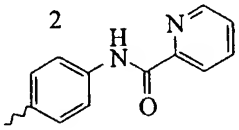
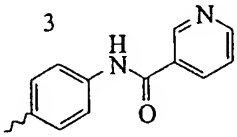
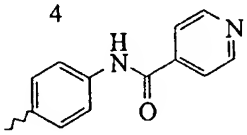
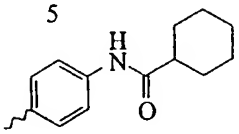
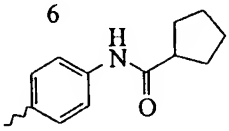
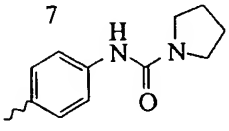
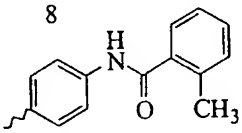
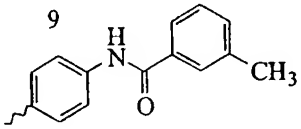
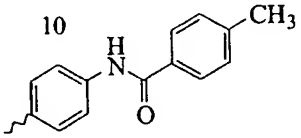
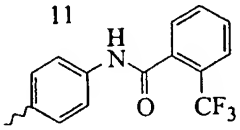
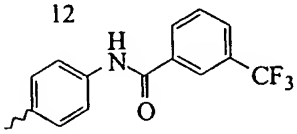
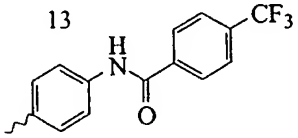
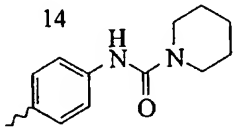
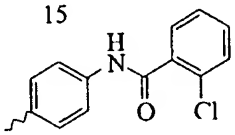
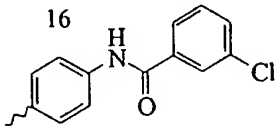
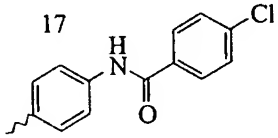
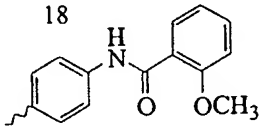
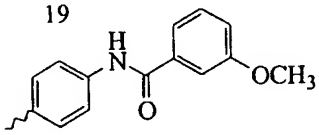
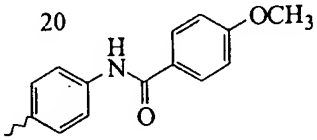
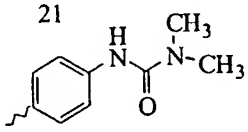


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

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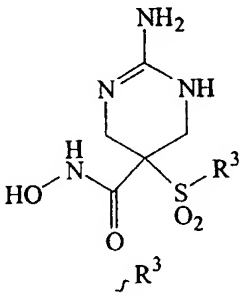


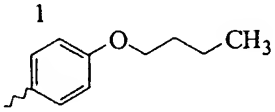
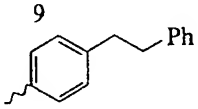
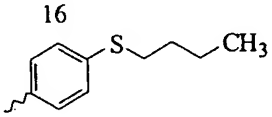
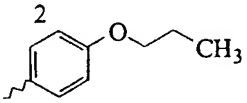
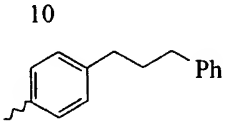
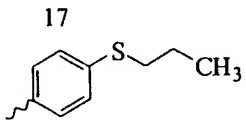
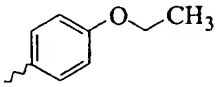
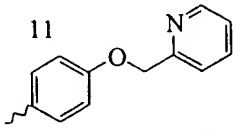
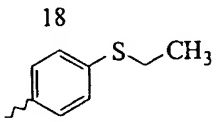
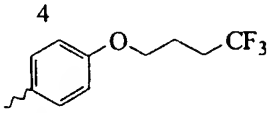
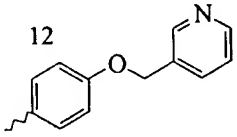
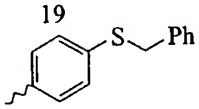
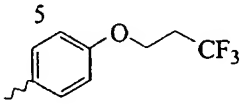
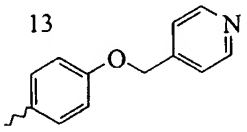
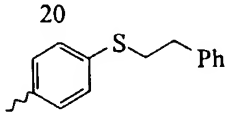
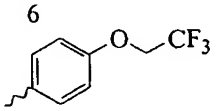
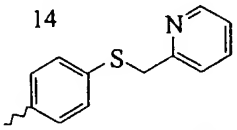
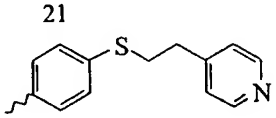
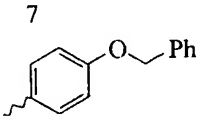
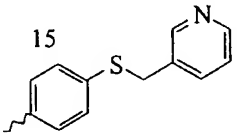
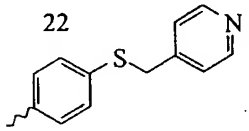
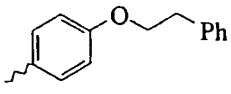
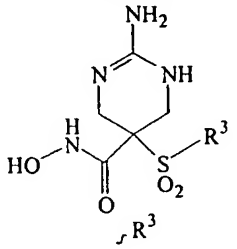
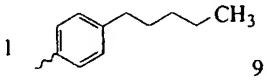
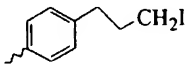
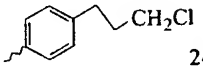
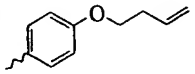
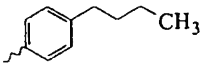
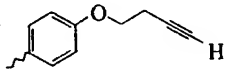
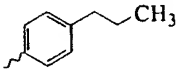
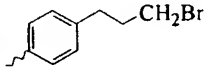
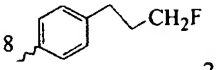
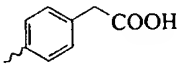
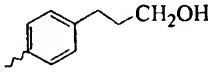
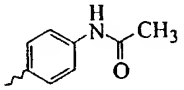
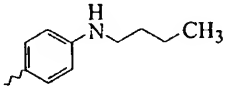
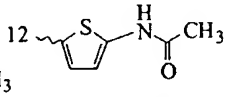
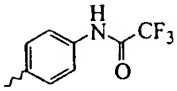
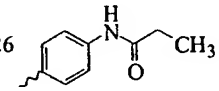
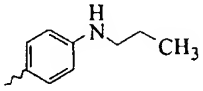
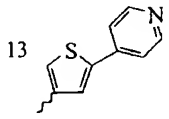
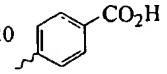
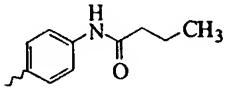
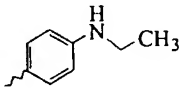
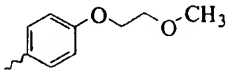
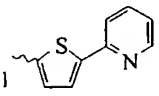
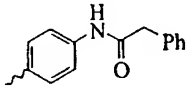
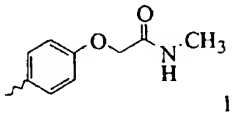
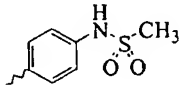
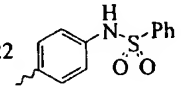
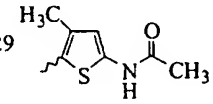
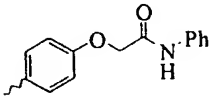
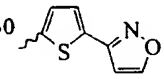
1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

Table 40



1 	9 	17 	23 
2 			24 
3 	10 	18 	
4 	11 		25 
5 	12 	19 	26 
6 	13 	20 	27 
7 	14 	21 	28 
8 	15 	22 	29 
	16 		30 

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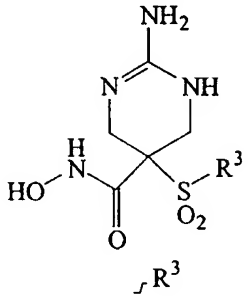
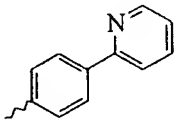
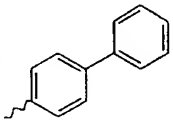
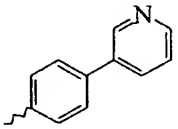
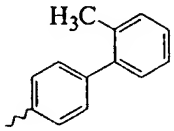
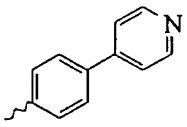
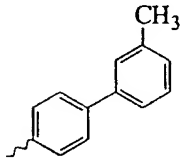
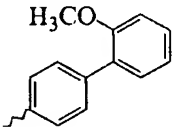
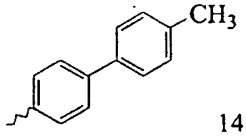
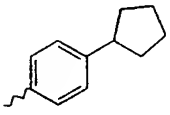
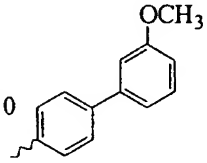
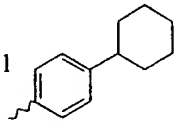
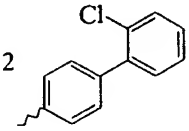
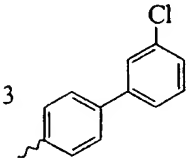
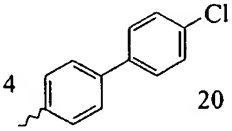
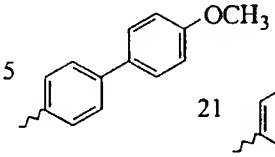
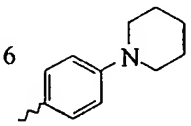
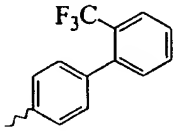
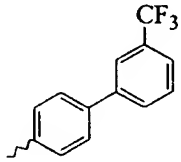
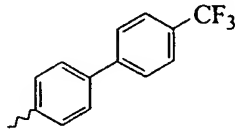
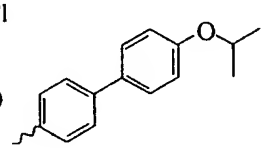
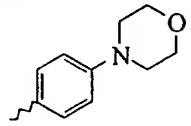


1		6	
2		7	
3		8	
4		9	
5		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	
		21	

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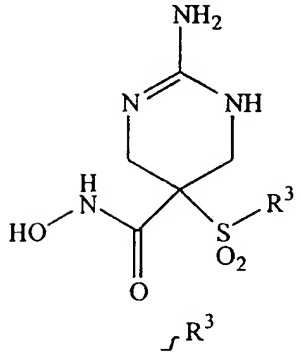


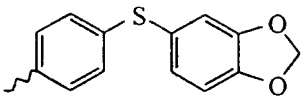
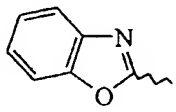
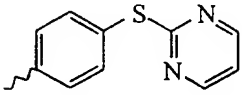
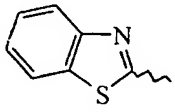
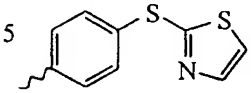
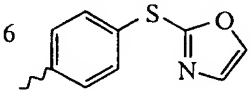
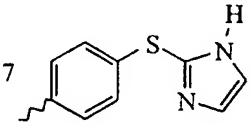
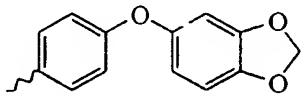
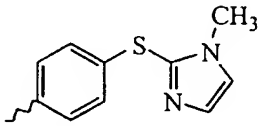
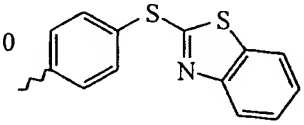
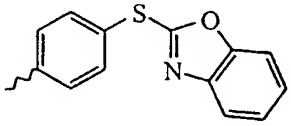
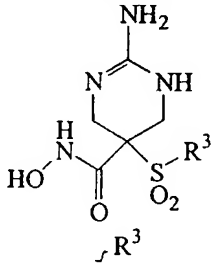
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Table 43



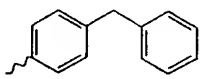
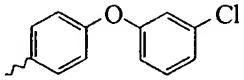
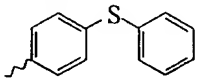
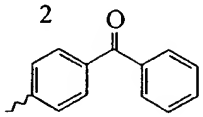
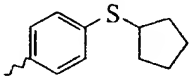
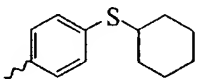
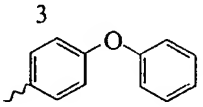
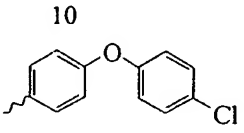
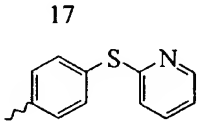
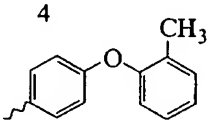
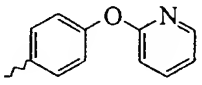
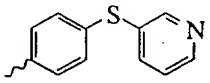
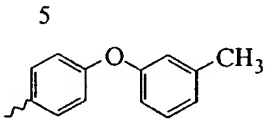
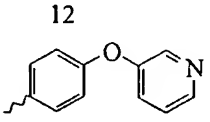
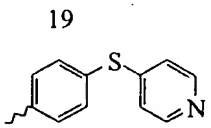
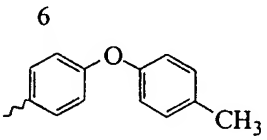
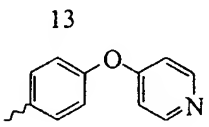
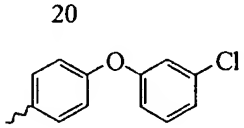
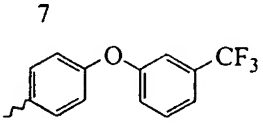
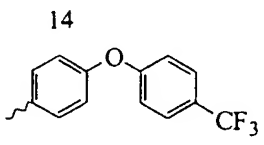
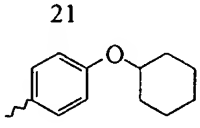
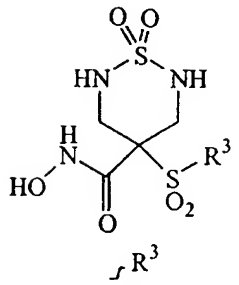
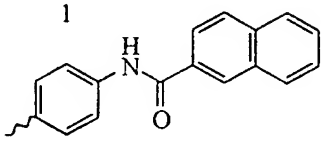
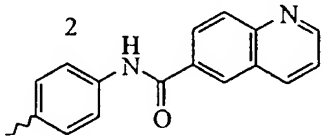
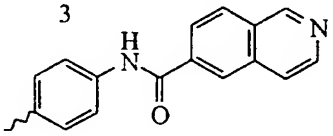
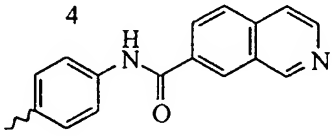
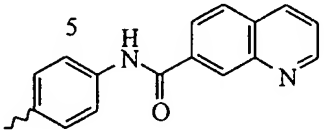
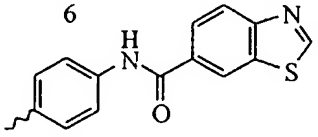
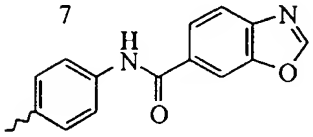
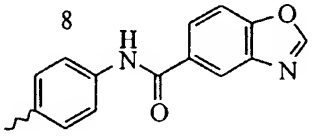
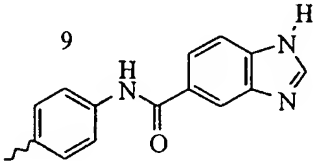
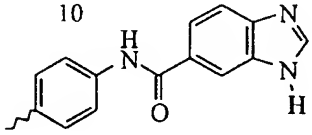
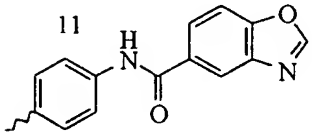
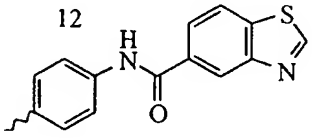
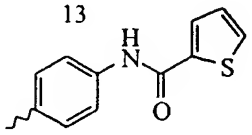
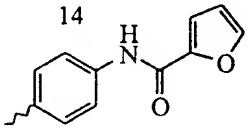
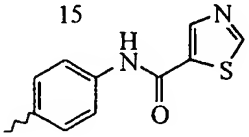
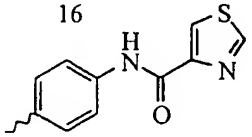
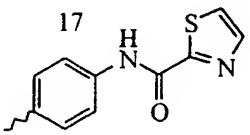
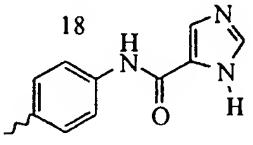
1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

Table 44



1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	

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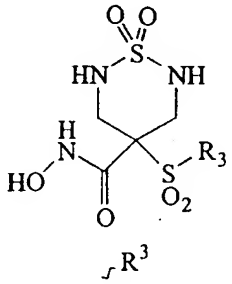


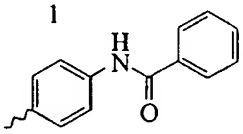
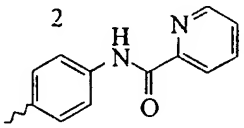
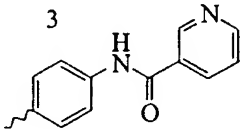
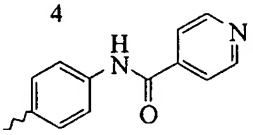
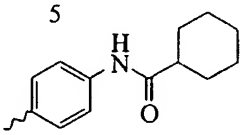
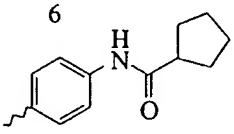
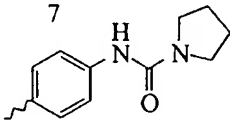
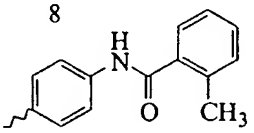
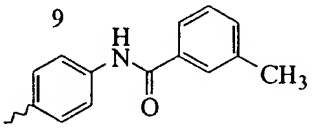
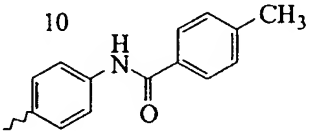
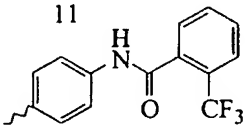
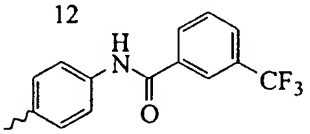
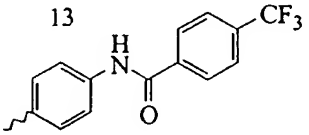
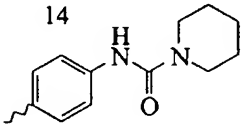
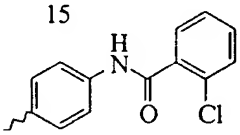
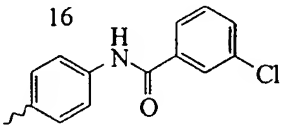
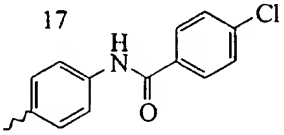
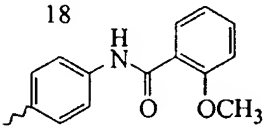
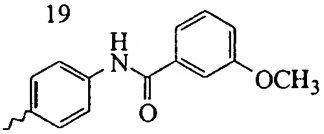
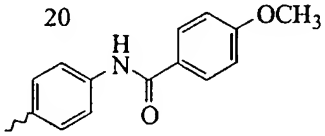
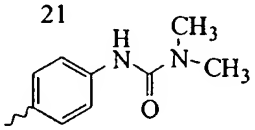
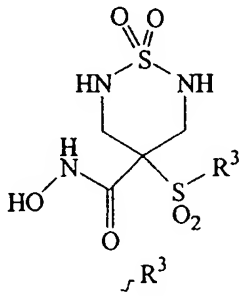
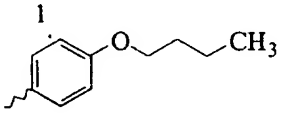
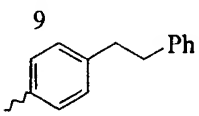
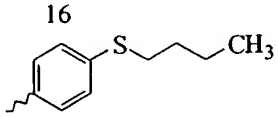
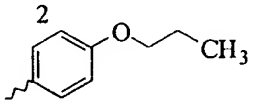
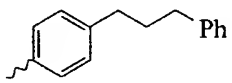
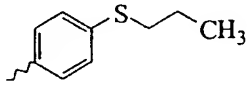
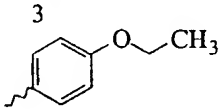
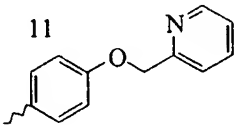
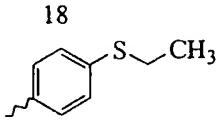
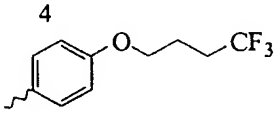
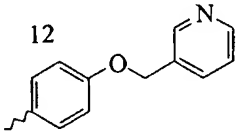
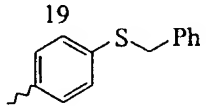
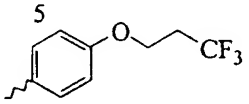
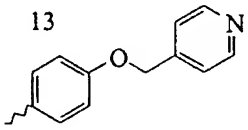
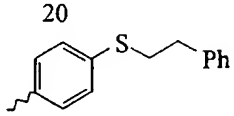
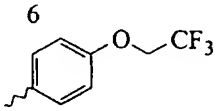
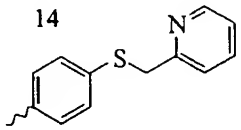
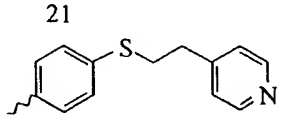
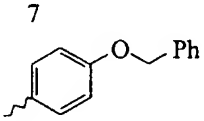
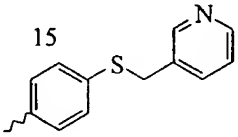
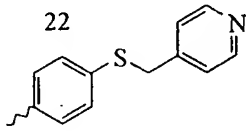
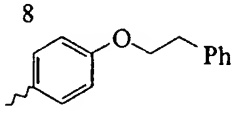
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

Table 46



1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

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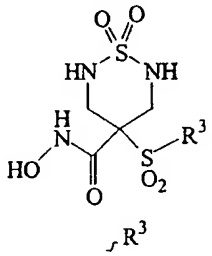

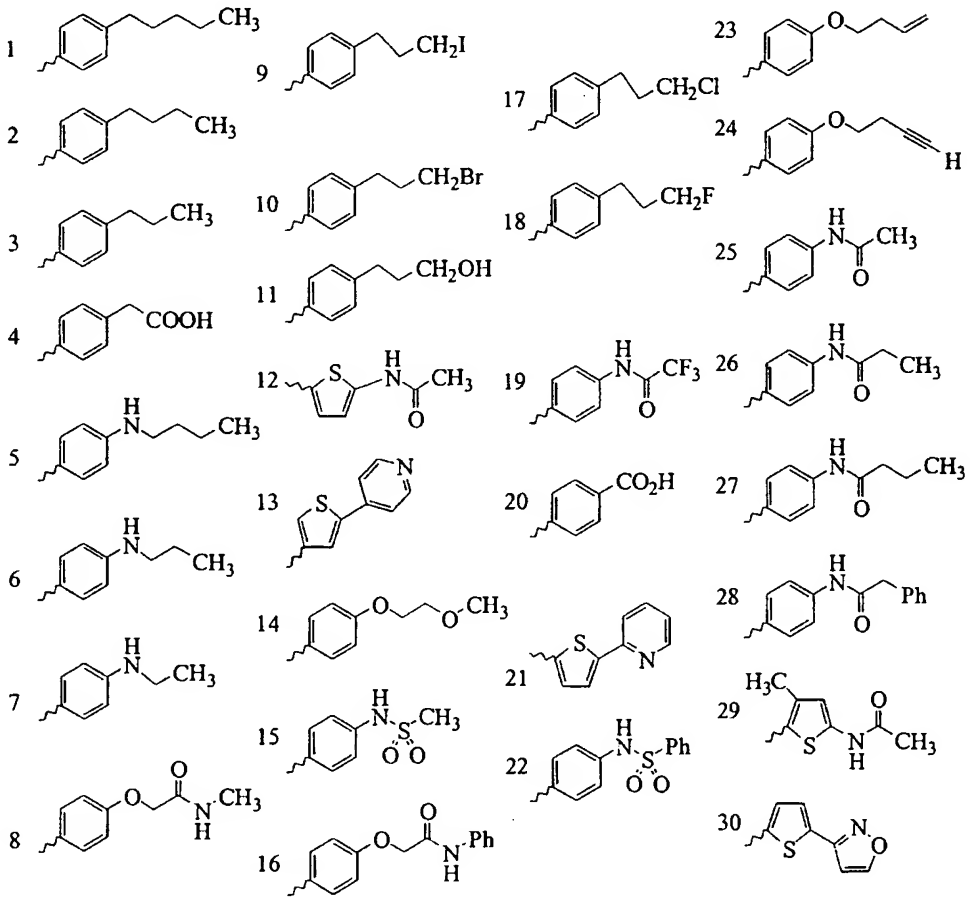
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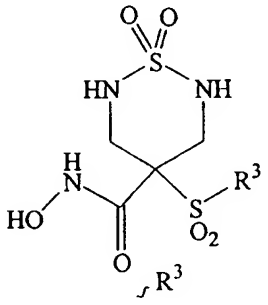
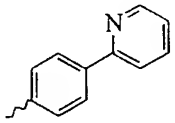
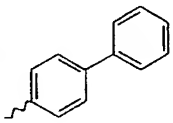
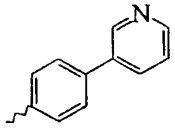
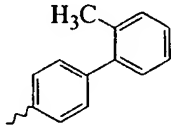
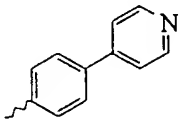
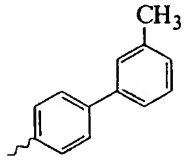
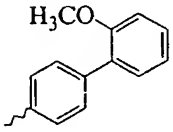
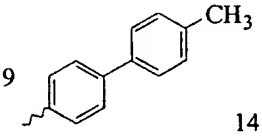
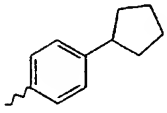
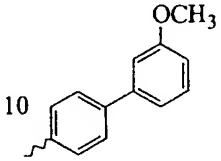
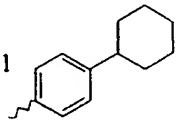
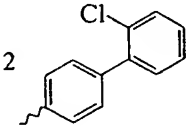
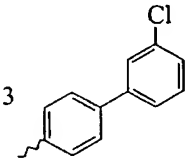
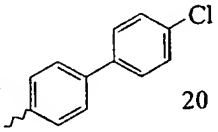
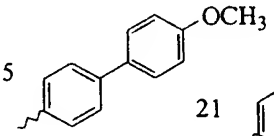
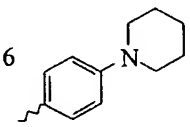
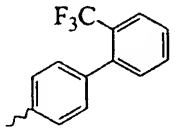
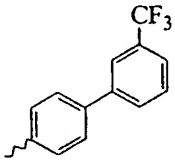
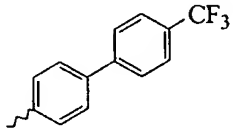
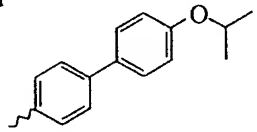
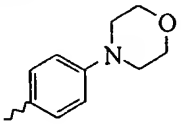
Table 48



1		6	
2		7	
3		8	
4		9	
5		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	
		21	

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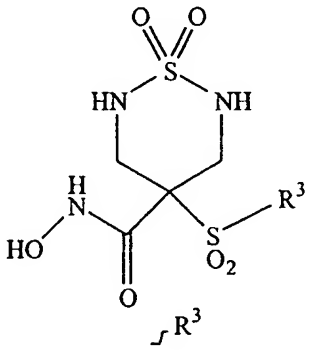
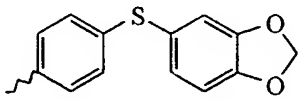
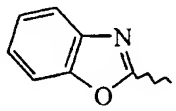
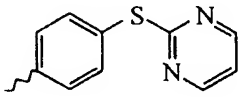
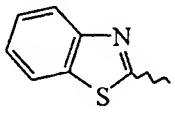
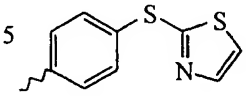
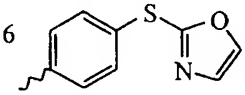
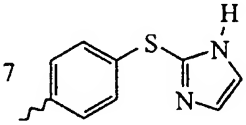
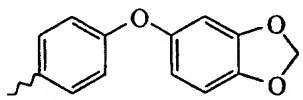
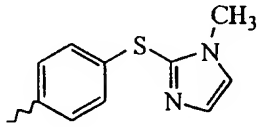
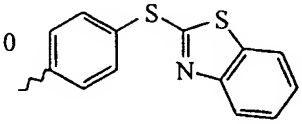
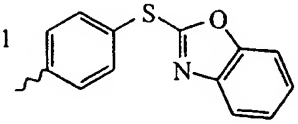


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

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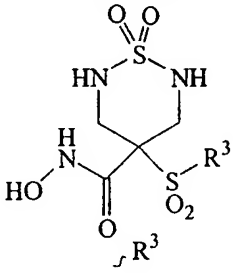
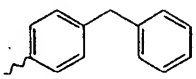
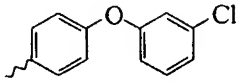
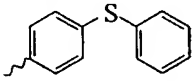
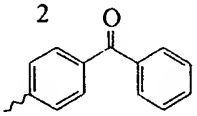
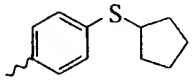
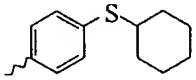
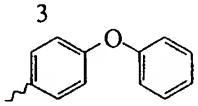
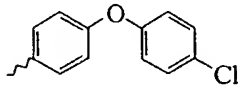
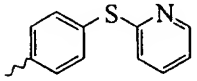
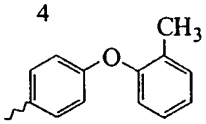
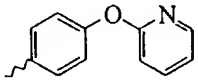
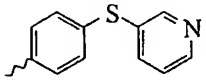
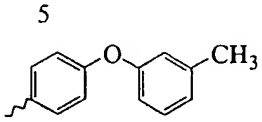
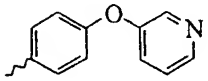
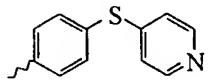
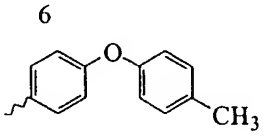
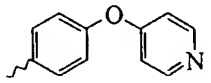
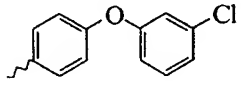
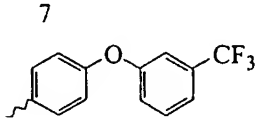
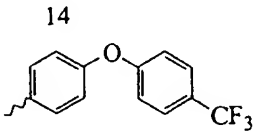
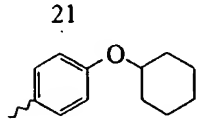


1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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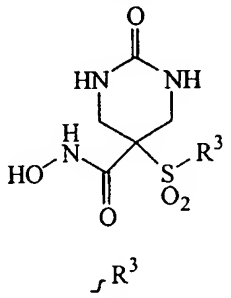
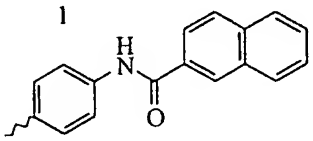
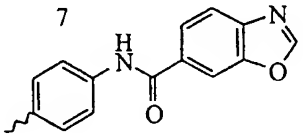
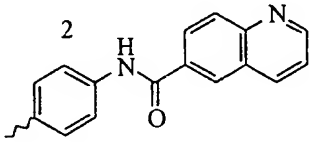
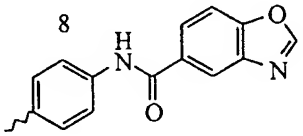
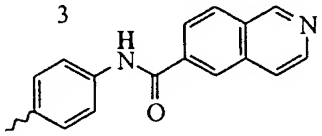
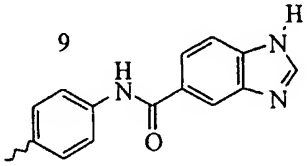
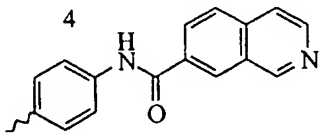
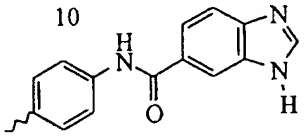
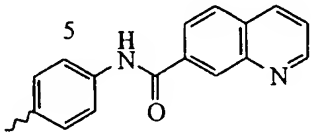
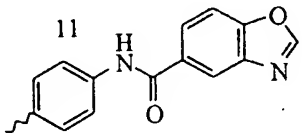
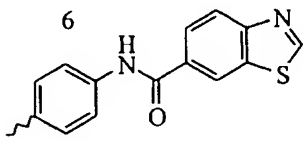
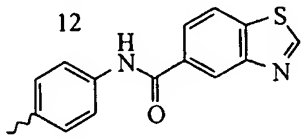
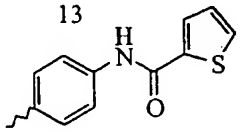
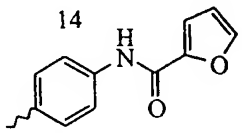
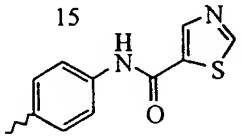
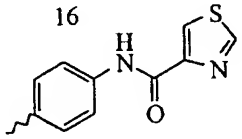
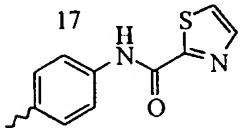
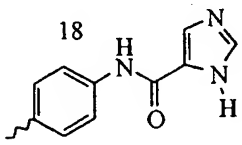


1 	7 
2 	8 
3 	9 
4 	10 
5 	11 
6 	12 
13 	14 
15 	16 
17 	18 

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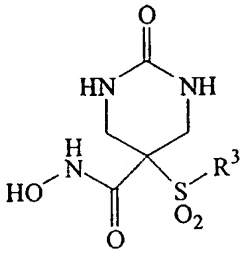

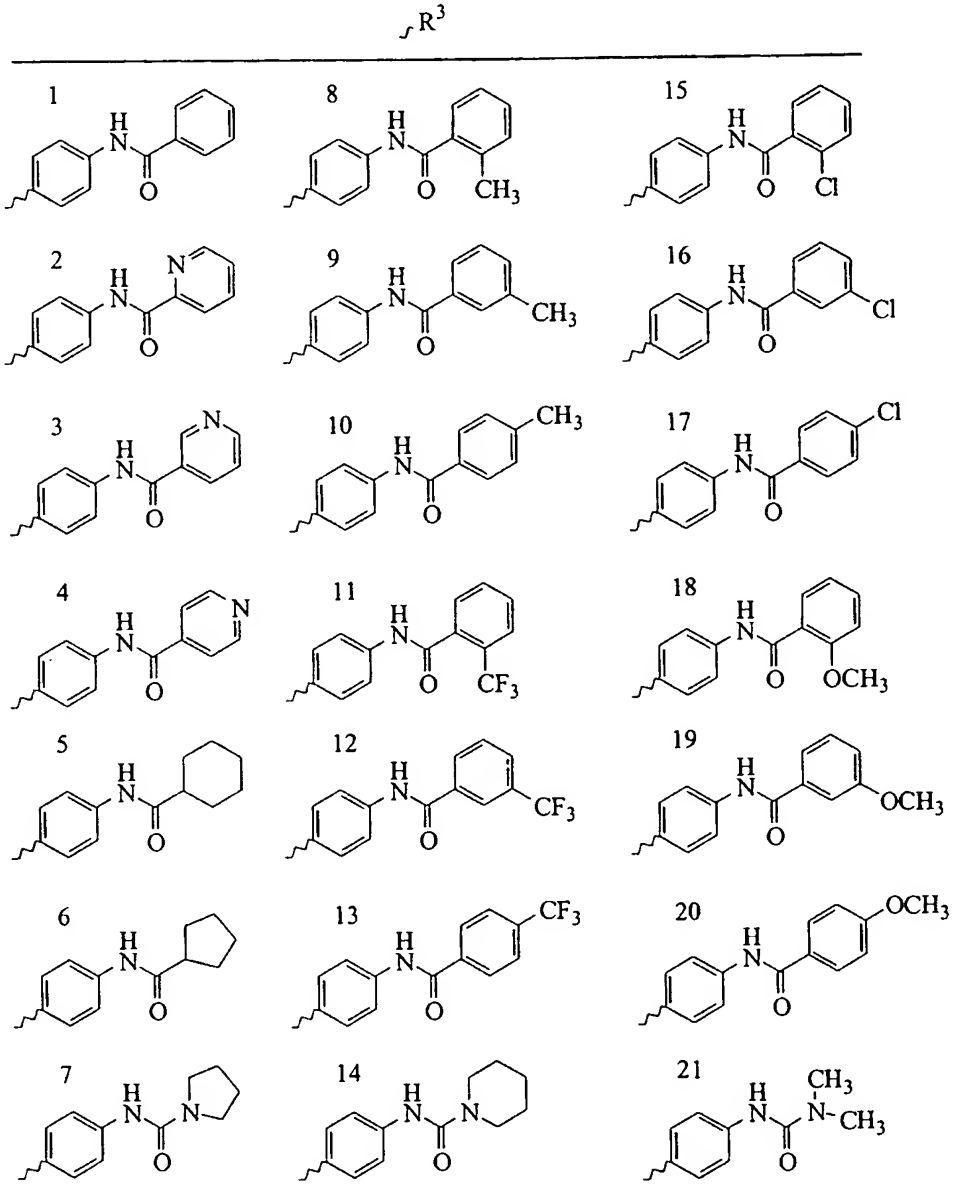

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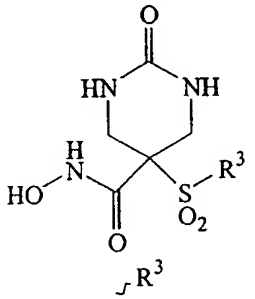


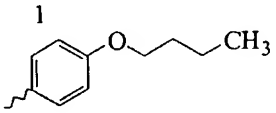
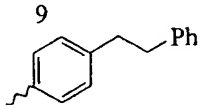
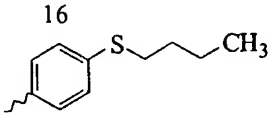
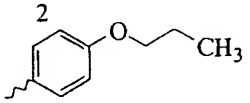
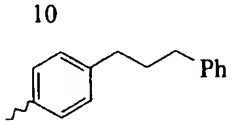
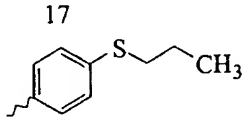
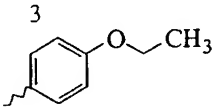
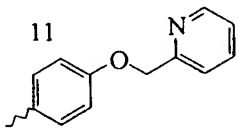
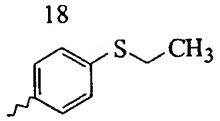
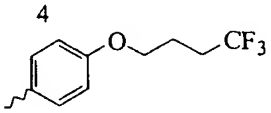
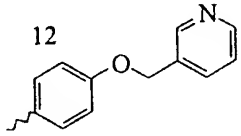
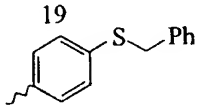
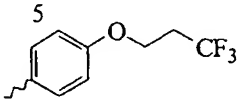
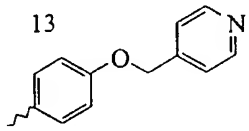
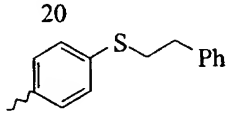
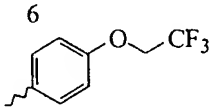
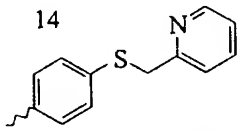
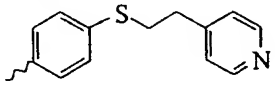
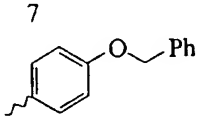
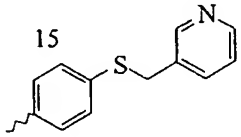
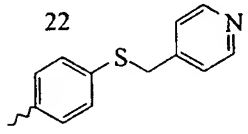
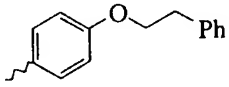
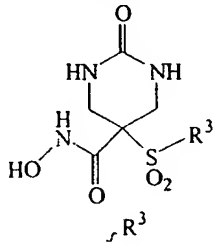
1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

Table 54



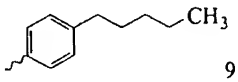
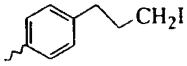
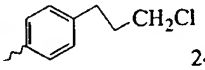
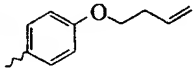
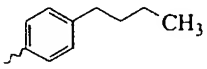
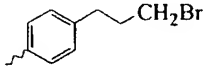
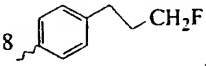
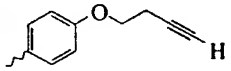
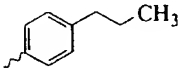
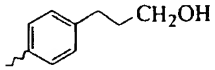
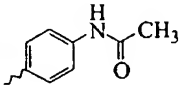
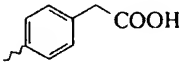
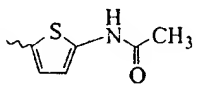
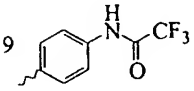
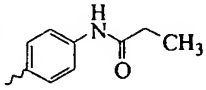
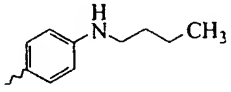
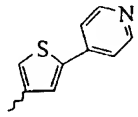
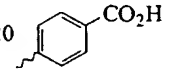
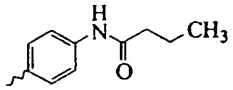
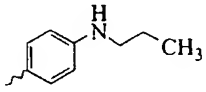
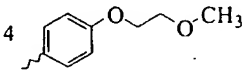
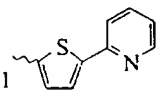
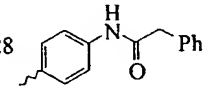
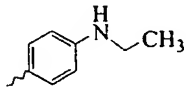
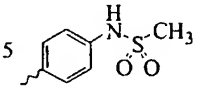
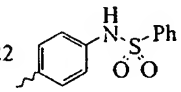
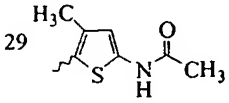
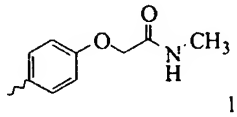
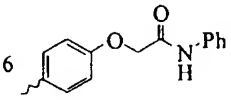
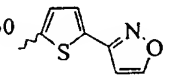
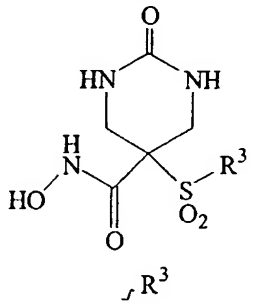
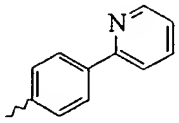
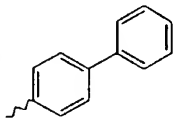
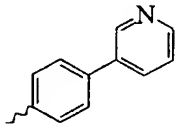
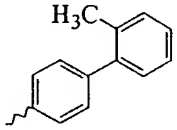
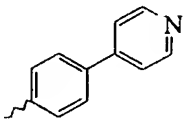
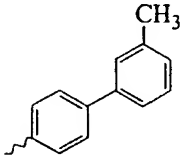
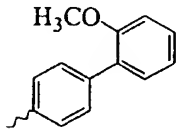
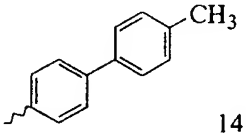
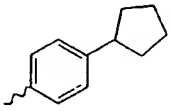
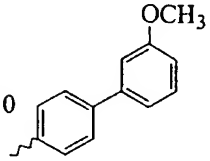
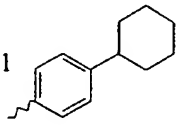
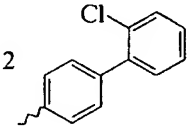
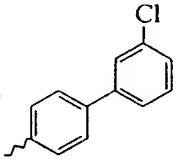
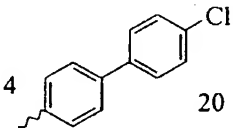
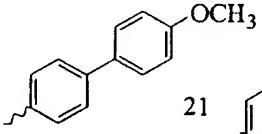
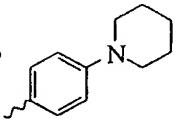
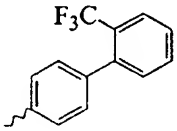
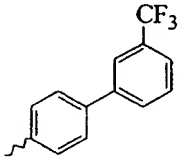
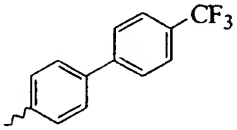
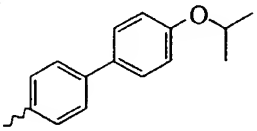
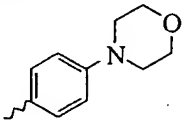
1		9		17		23	
2		10		18		24	
3		11		25	
4		12		19		26	
5		13		20		27	
6		14		21		28	
7		15		22		29	
8		16		30	

Table 55



1		6	
2		7	
3		8	
4		9	
5		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	
		21	

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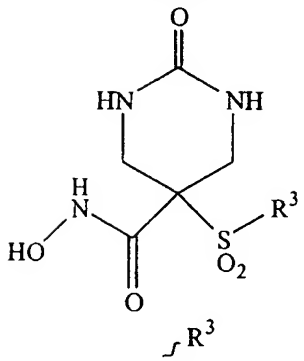


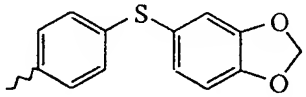
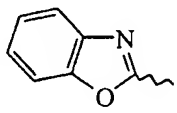
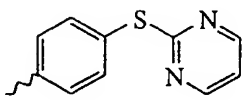
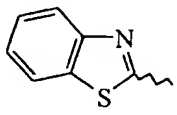
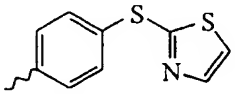
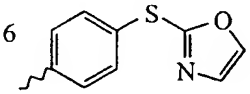
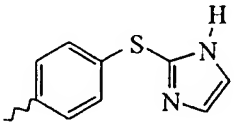
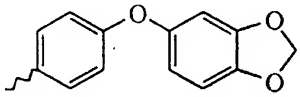
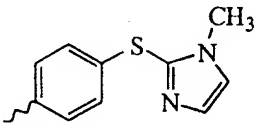
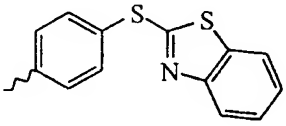
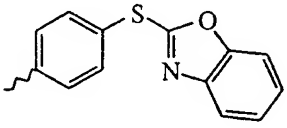
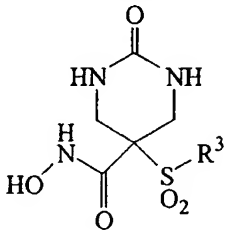
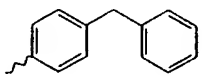
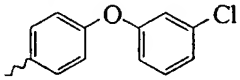
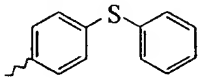
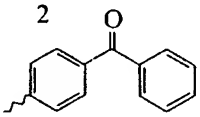
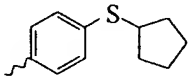
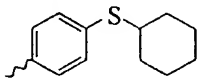
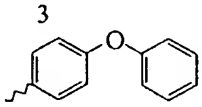
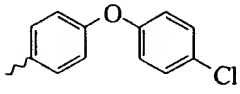
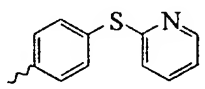
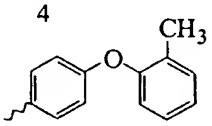
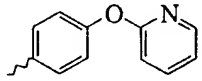
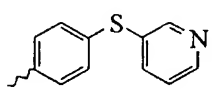
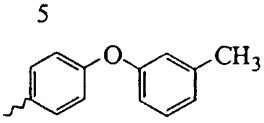
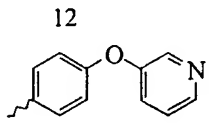
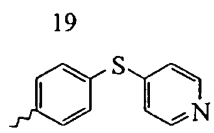
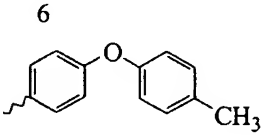
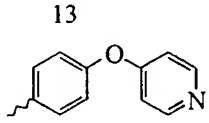
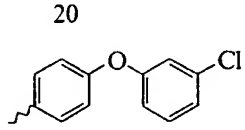
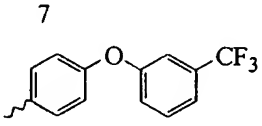
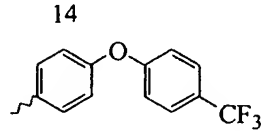
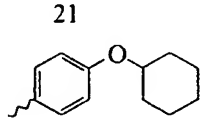
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Table 57



R^3

1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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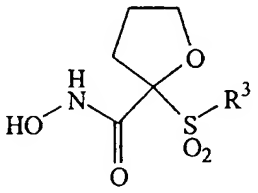
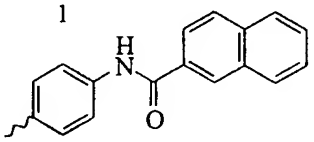
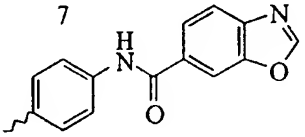
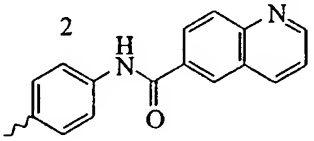
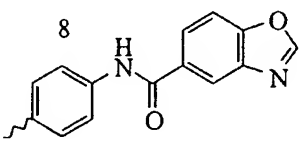
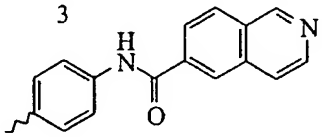
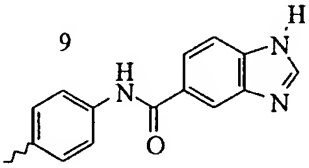
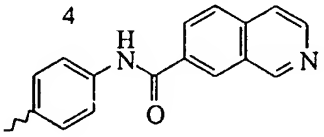
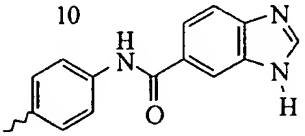
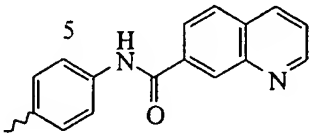
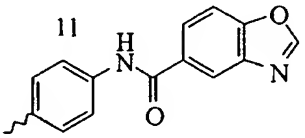
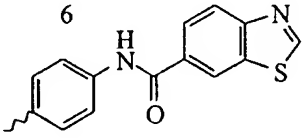
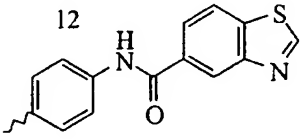
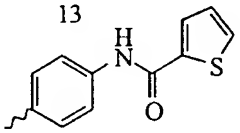
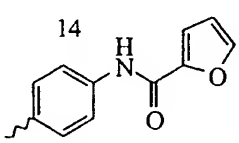
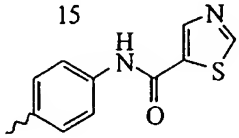
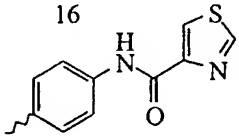
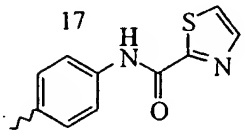
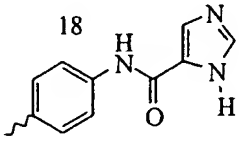


1		7	
2		8	
3		9	
4		10	
5		11	
6		12	
13			
14			
15			
16			
17			
18			

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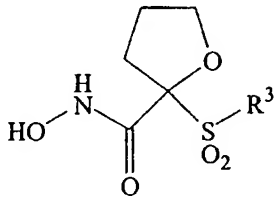


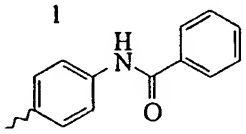
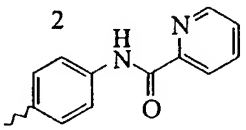
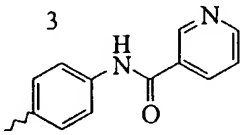
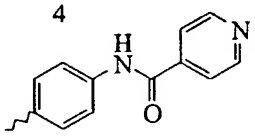
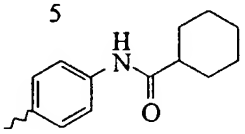
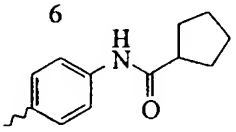
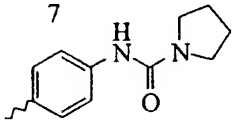
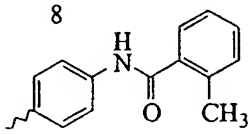
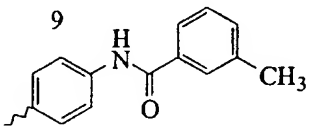
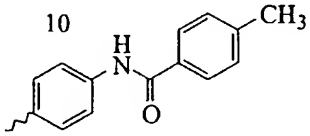
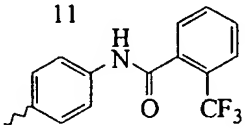
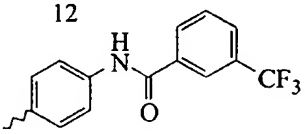
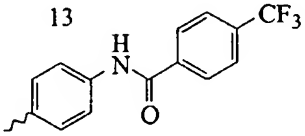
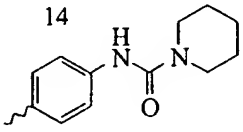
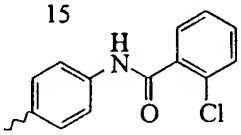
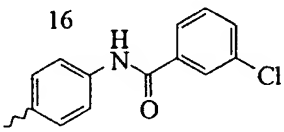
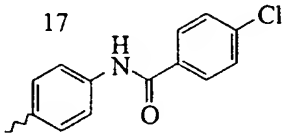
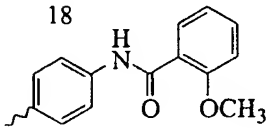
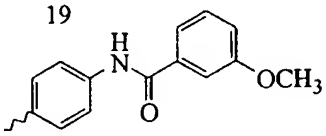
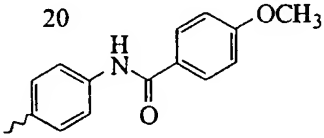
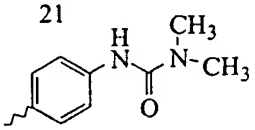
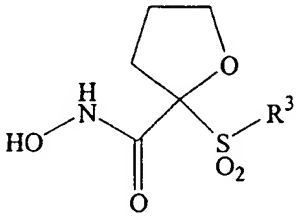
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

Table 60



R^3

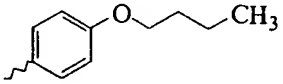
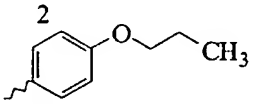
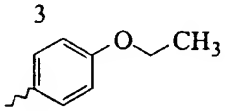
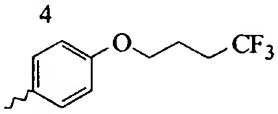
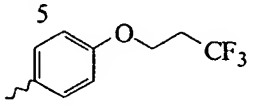
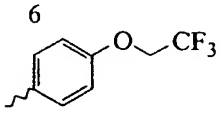
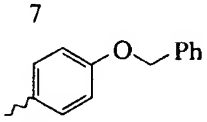
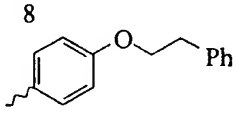
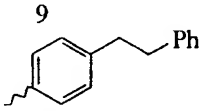
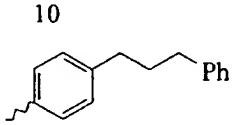
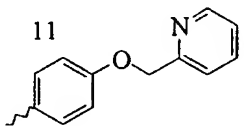
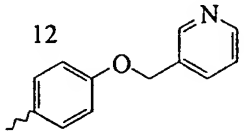
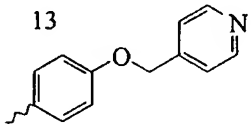
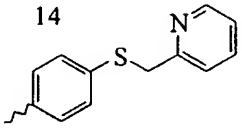
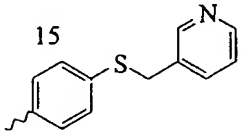
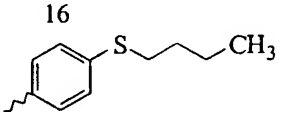
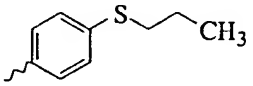
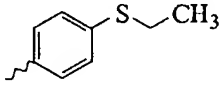
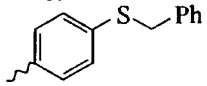
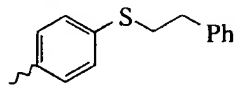
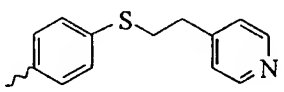
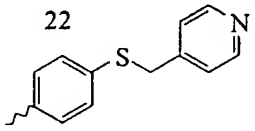
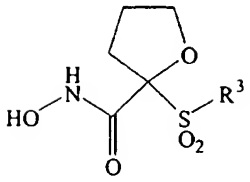
	R^3
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	

Table 61



R^3

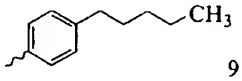
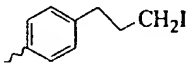
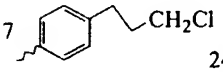
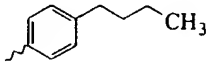
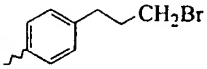
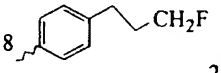
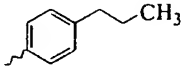
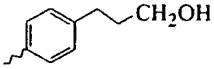
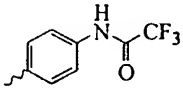
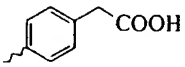
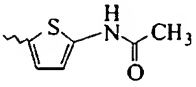
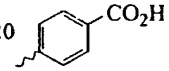
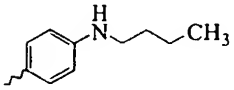
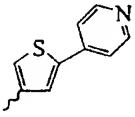
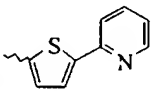
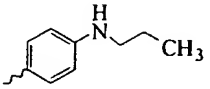
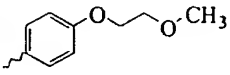
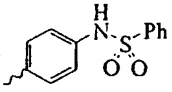
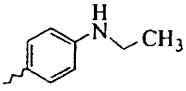
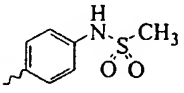
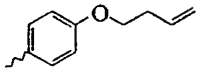
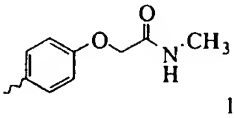
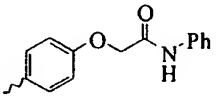
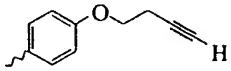
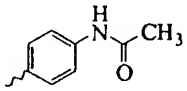
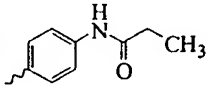
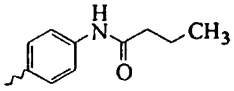
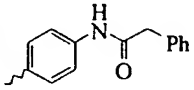
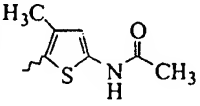
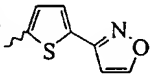
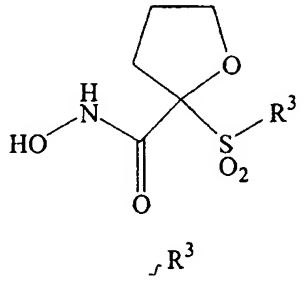
1		9		17	
2		10		18	
3		11		19	
4		12		20	
5		13		21	
6		14		22	
7		15		23	
8		16		24	
				25	
				26	
				27	
				28	
				29	
				30	

Table 62



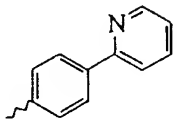
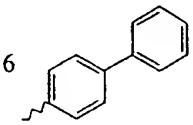
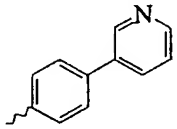
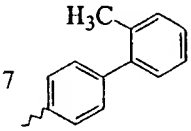
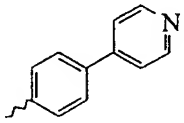
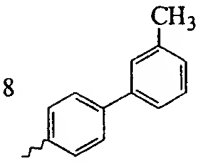
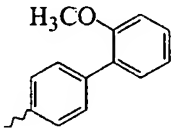
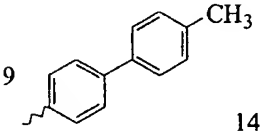
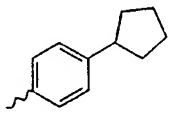
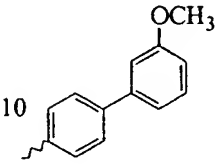
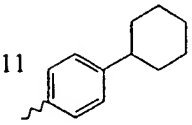
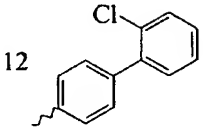
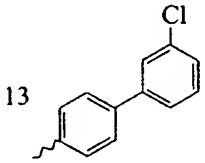
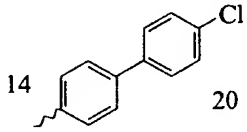
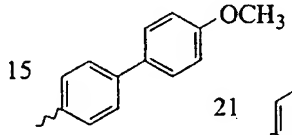
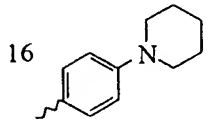
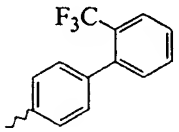
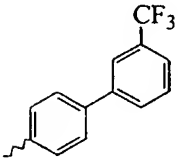
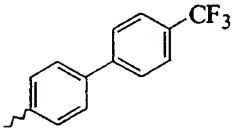
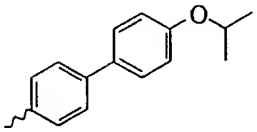
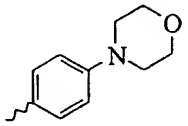
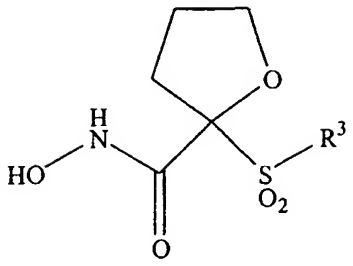
1		6	
2		7	
3		8	
4		9	
5		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	
		21	

Table 63



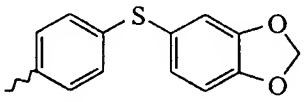
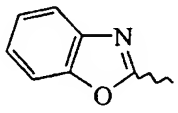
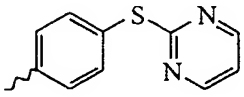
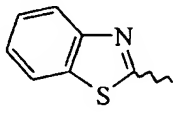
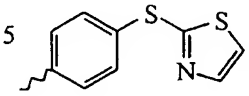
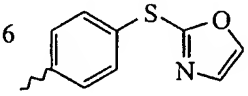
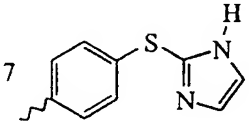
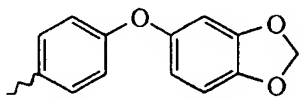
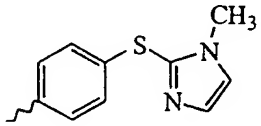
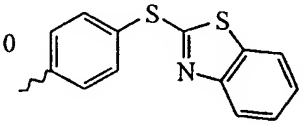
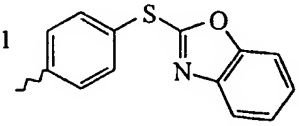
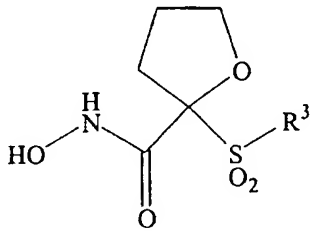
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Table 64



R^3

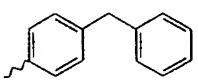
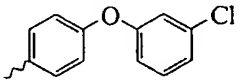
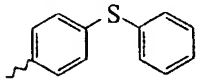
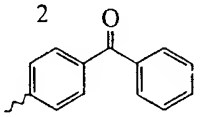
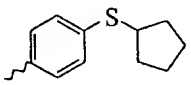
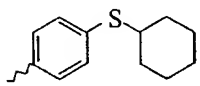
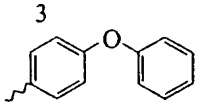
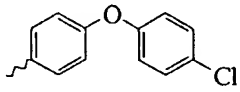
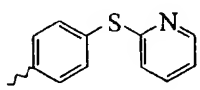
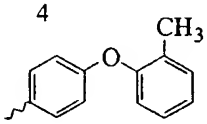
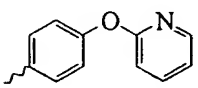
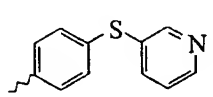
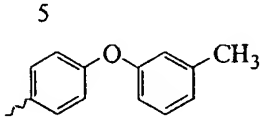
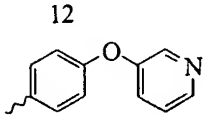
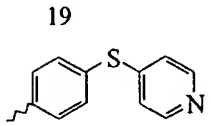
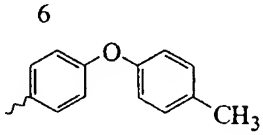
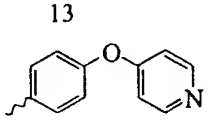
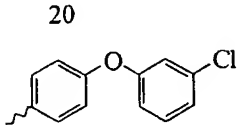
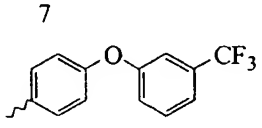
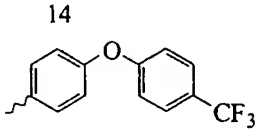
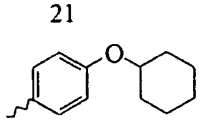
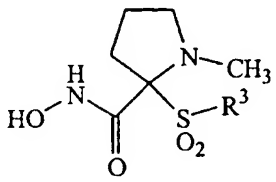
1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

Table 65



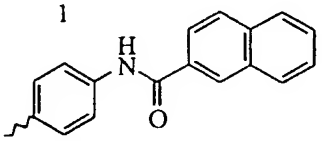
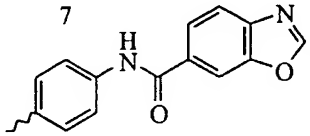
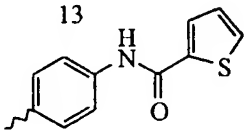
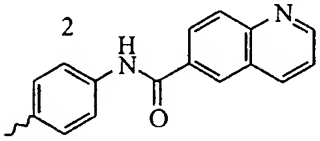
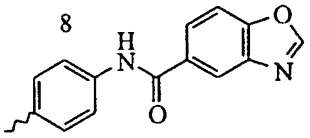
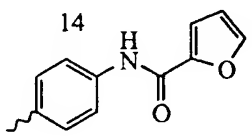
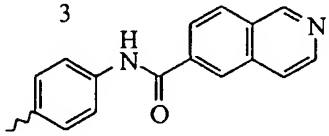
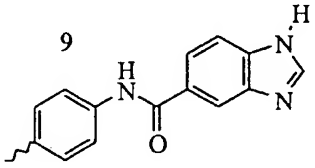
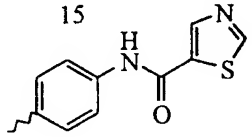
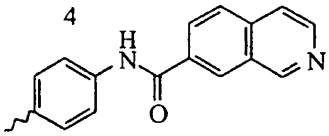
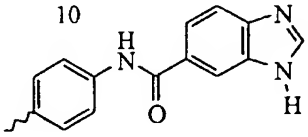
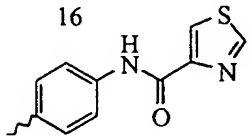
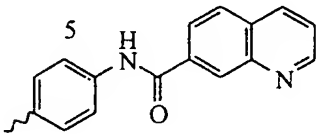
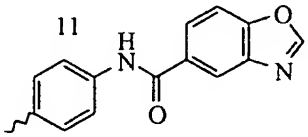
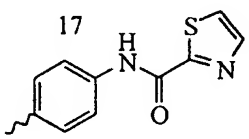
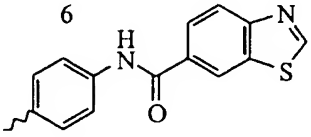
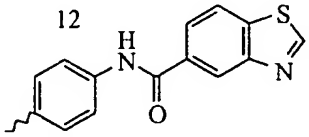
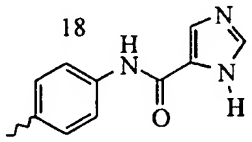
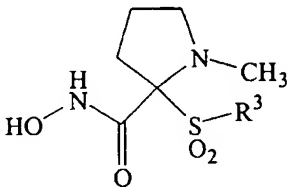
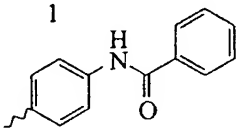
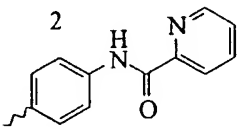
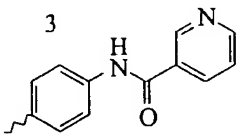
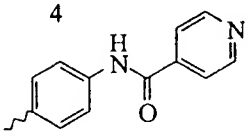
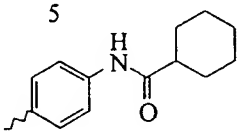
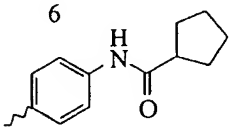
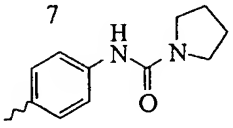
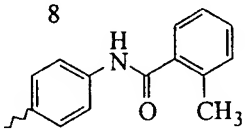
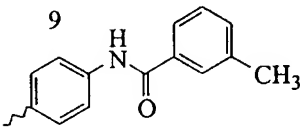
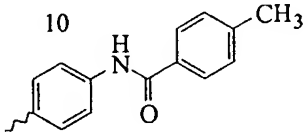
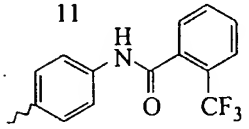
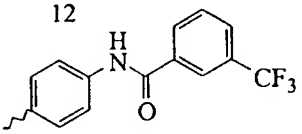
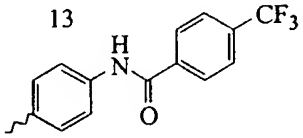
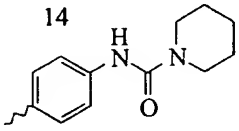
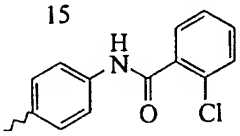
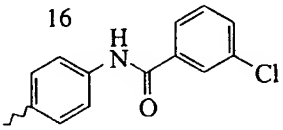
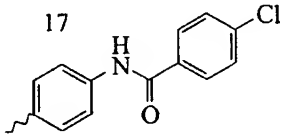
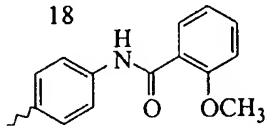
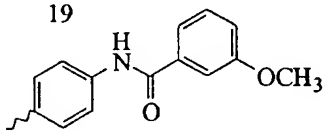
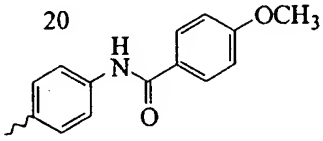
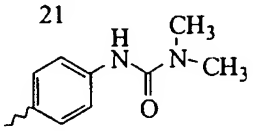
1 	7 	13 
2 	8 	14 
3 	9 	15 
4 	10 	16 
5 	11 	17 
6 	12 	18 

Table 66



	R^3
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

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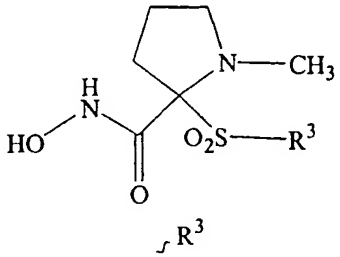
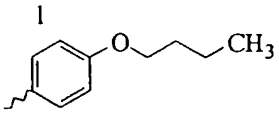
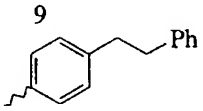
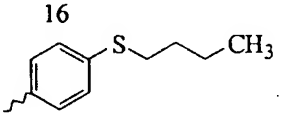
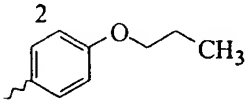
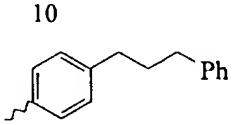
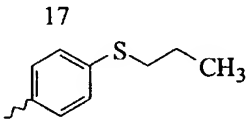
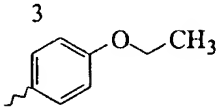
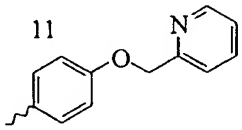
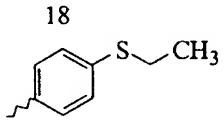
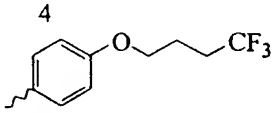
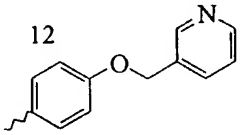
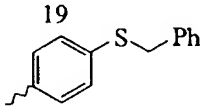
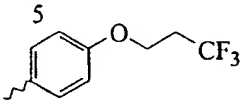
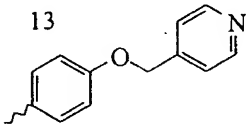
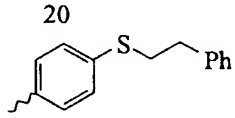
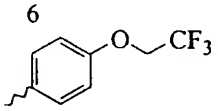
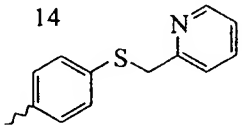
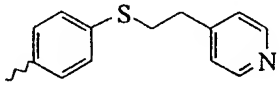
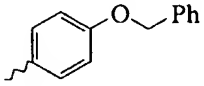
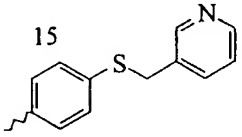
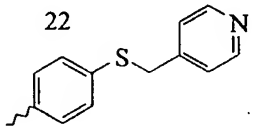
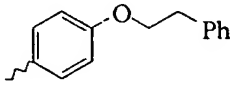


1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

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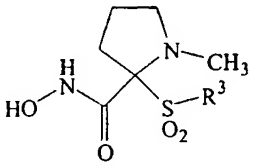

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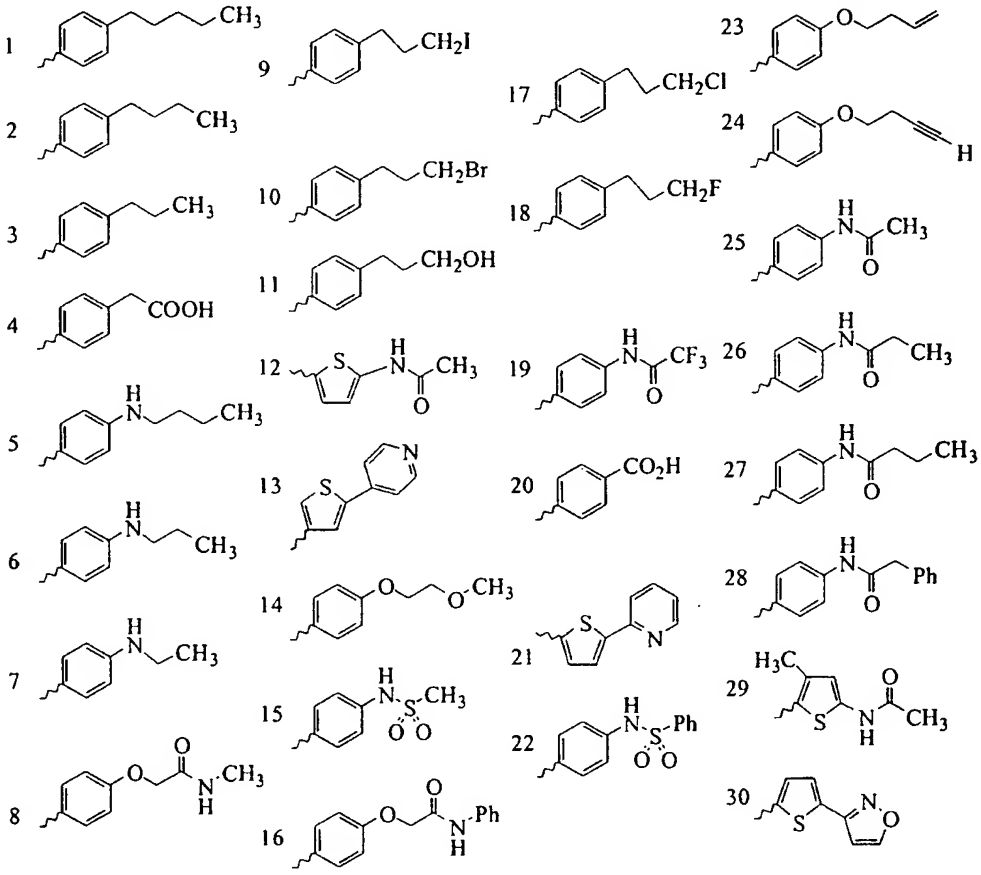
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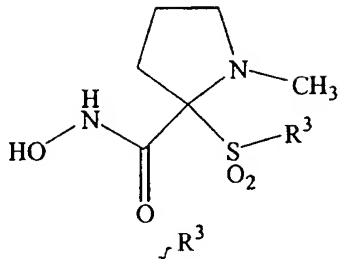
Table 69



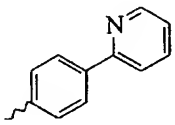
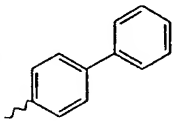
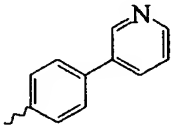
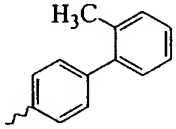
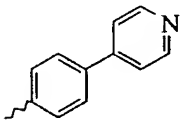
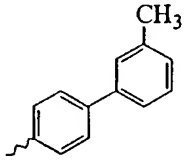
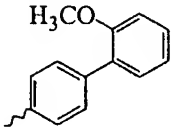
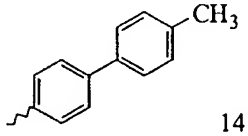
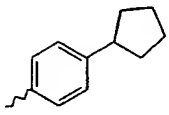
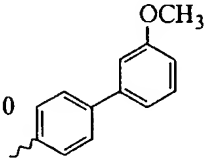
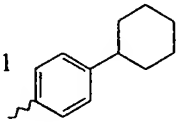
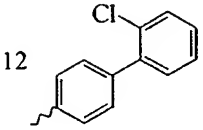
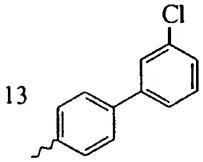
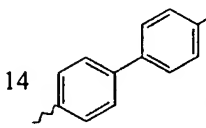
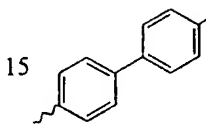
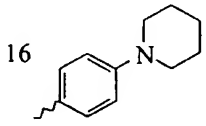
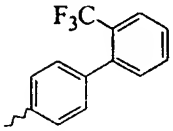
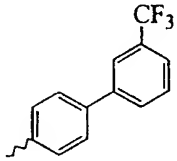
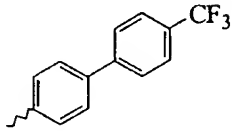
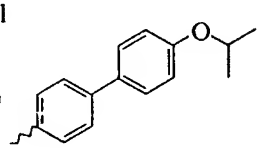
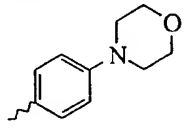
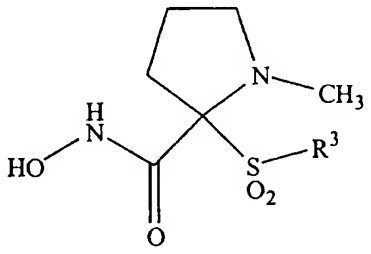
1		6	
2		7	
3		8	
4		9	
5		10	
11		12	
13		14	
15		16	
17		18	
19		20	
21			

Table 70



R^3

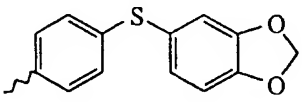
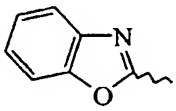
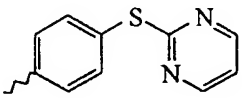
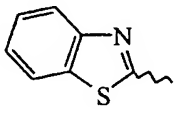
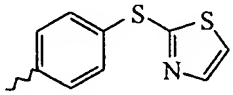
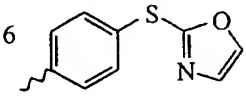
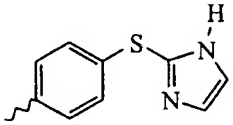
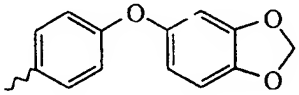
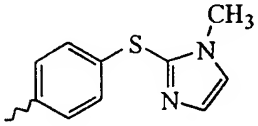
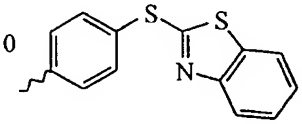
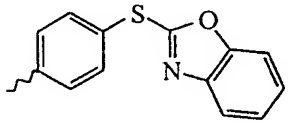
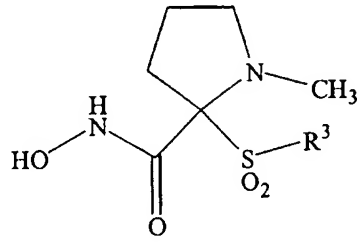
	R^3
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Table 71



R^3

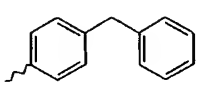
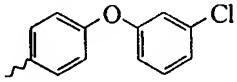
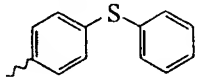
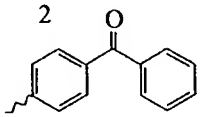
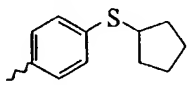
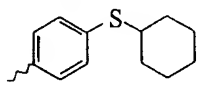
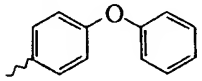
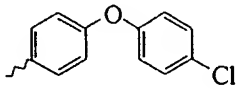
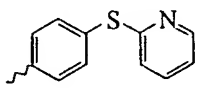
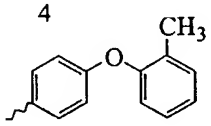
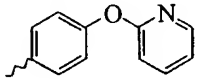
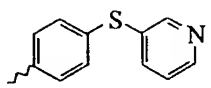
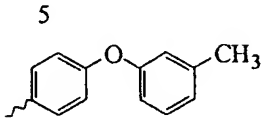
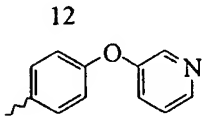
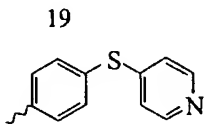
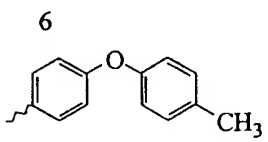
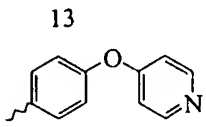
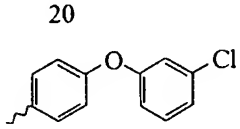
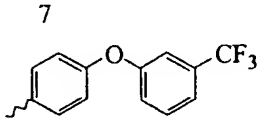
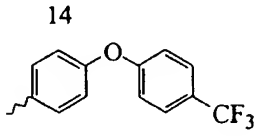
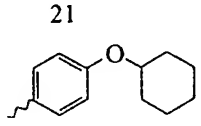
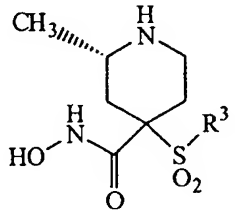
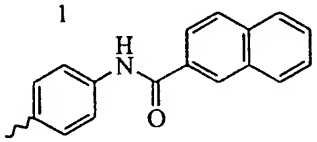
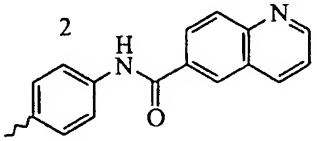
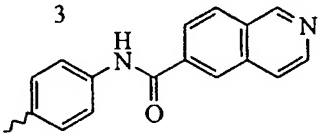
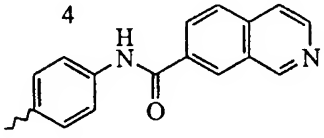
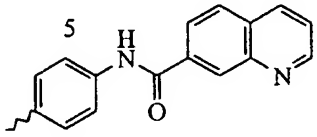
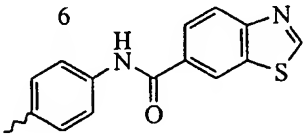
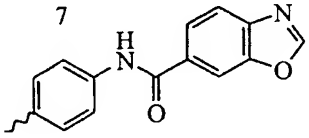
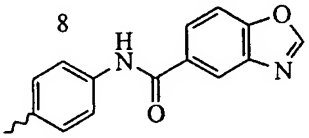
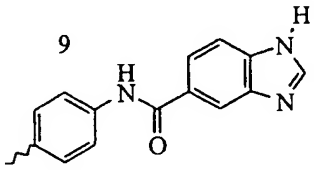
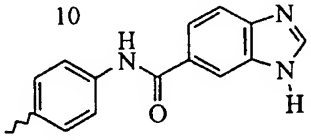
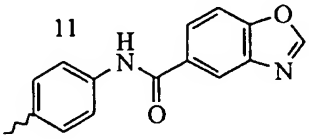
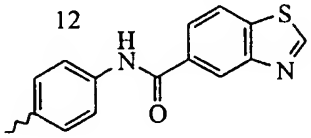
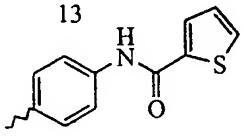
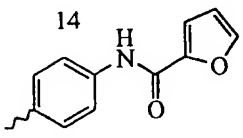
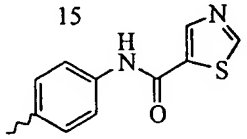
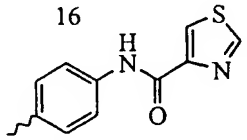
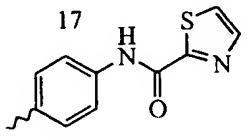
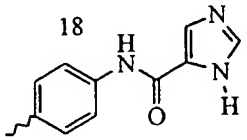
1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

Table 72



1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	

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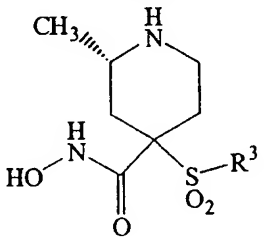

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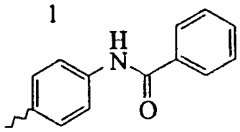
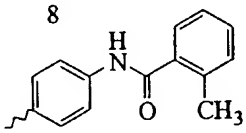
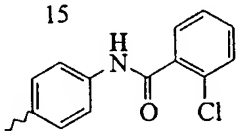
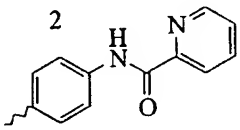
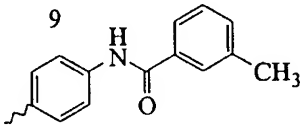
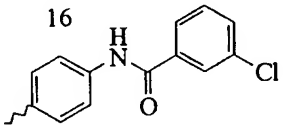
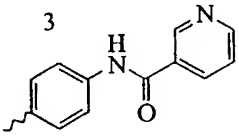
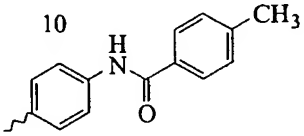
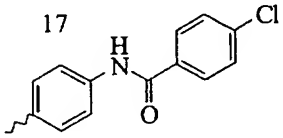
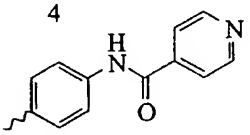
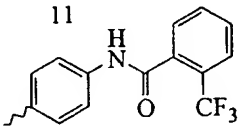
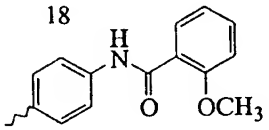
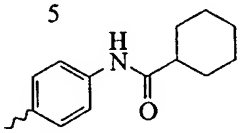
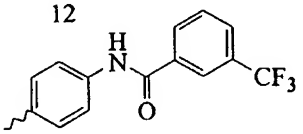
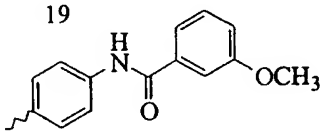
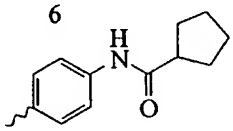
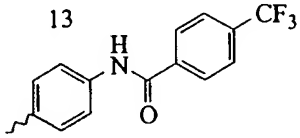
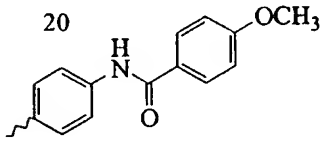
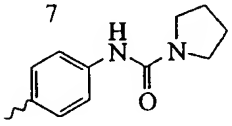
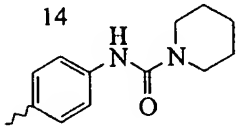
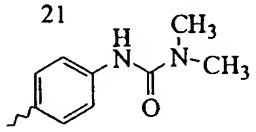
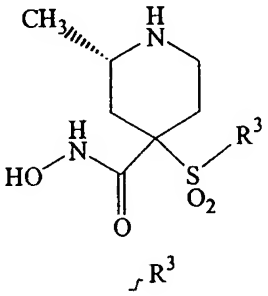
1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

Table 74



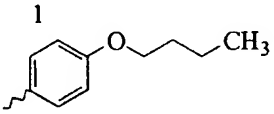
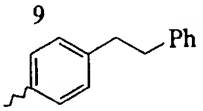
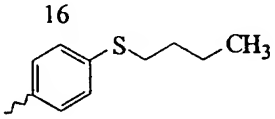
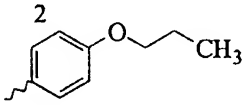
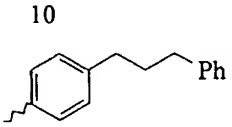
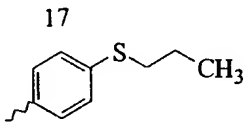
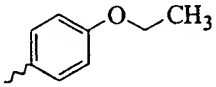
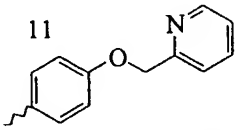
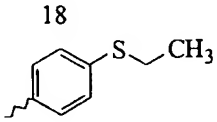
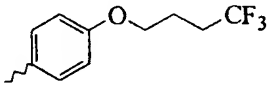
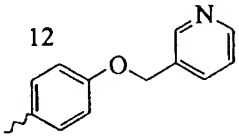
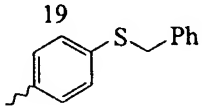
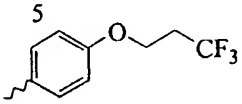
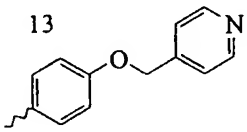
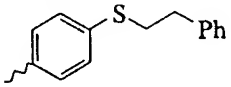
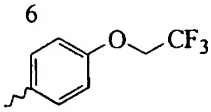
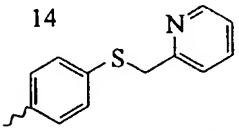
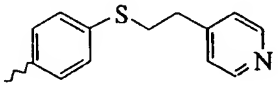
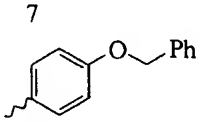
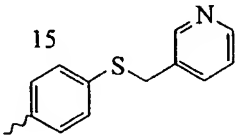
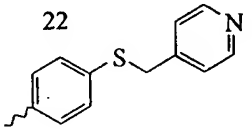
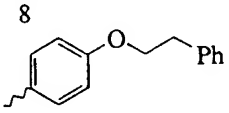
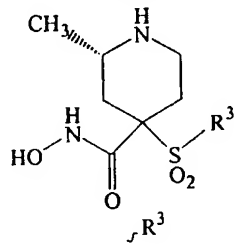
1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

Table 75



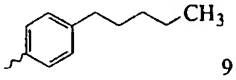
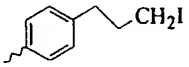
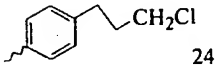
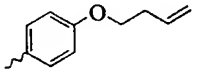
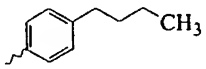
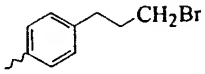
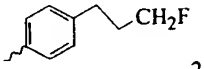
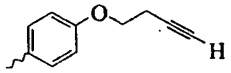
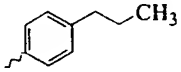
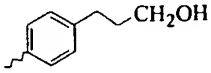
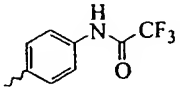
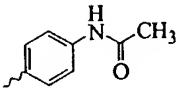
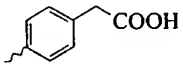
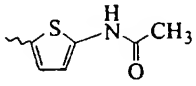
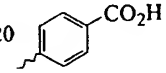
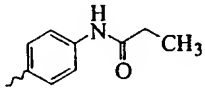
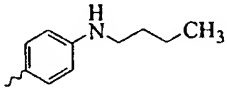
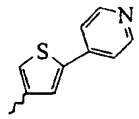
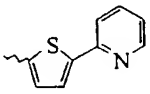
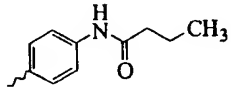
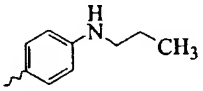
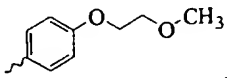
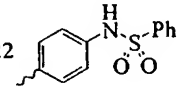
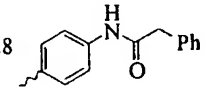
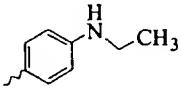
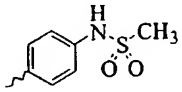
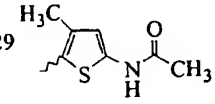
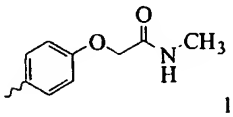
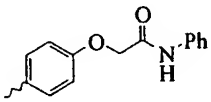
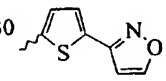
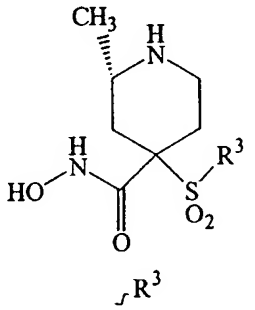
1		9		17		23	
2		10		18		24	
3		11		19		25	
4		12		20		26	
5		13		21		27	
6		14		22		28	
7		15				29	
8		16				30	

Table 76



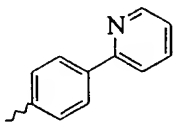
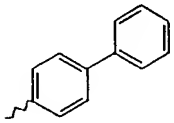
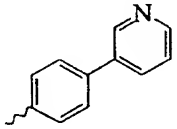
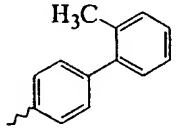
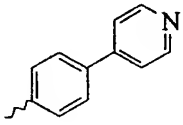
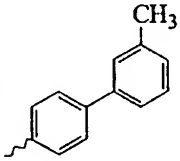
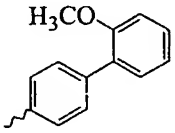
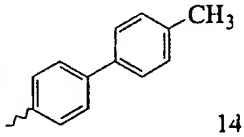
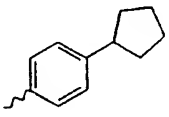
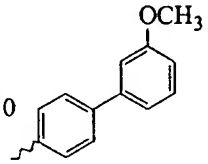
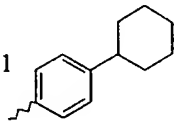
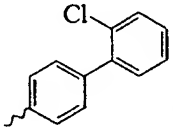
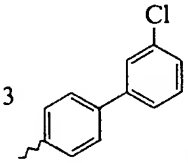
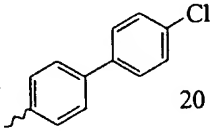
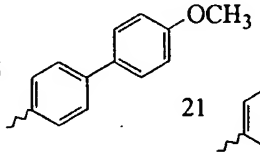
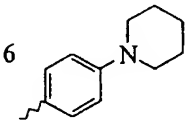
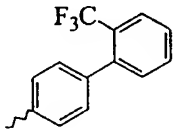
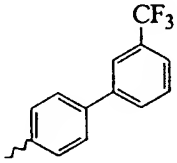
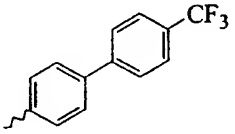
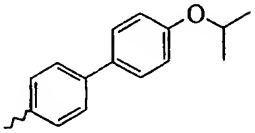
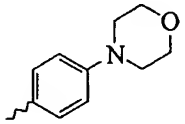
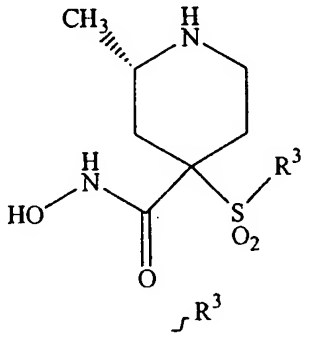
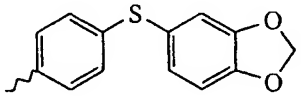
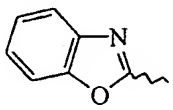
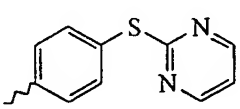
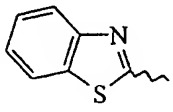
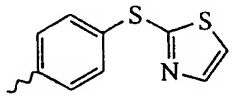
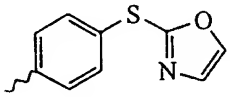
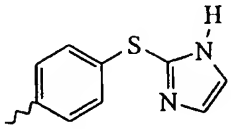
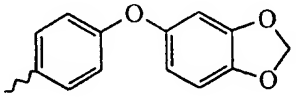
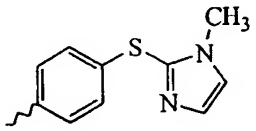
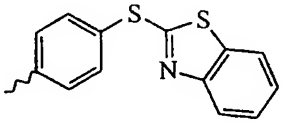
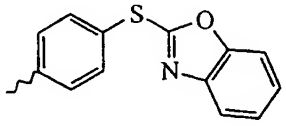
1		6	
2		7	
3		8	
4		9	
5		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	
		21	

Table 77



1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

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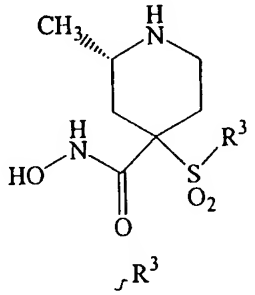
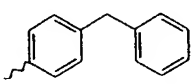
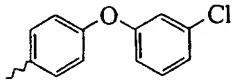
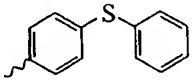
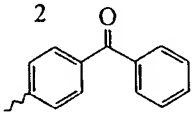
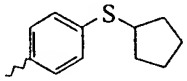
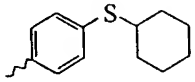
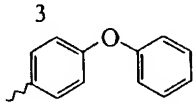
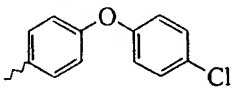
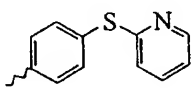
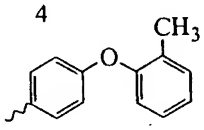
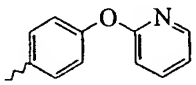
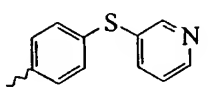
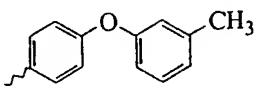
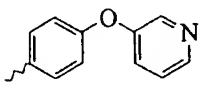
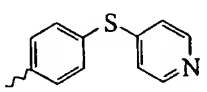
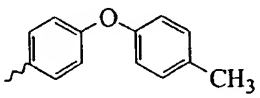
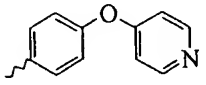
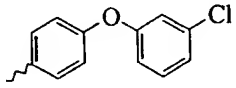
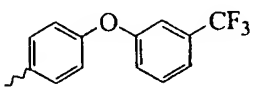
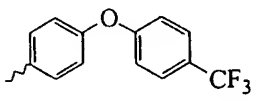
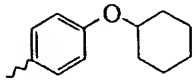


1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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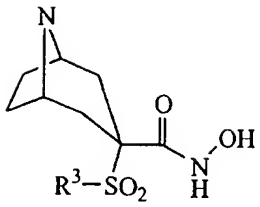
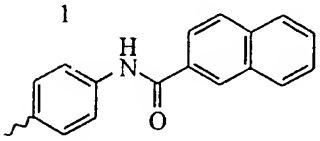
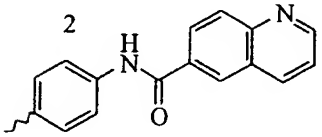
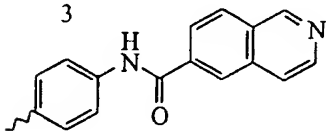
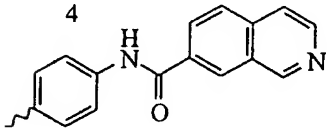
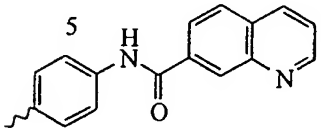
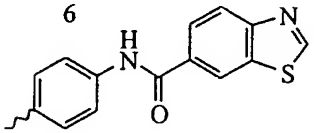
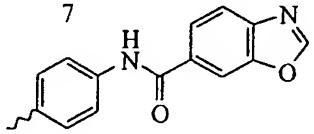
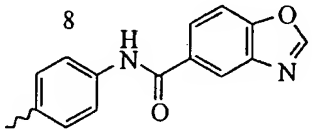
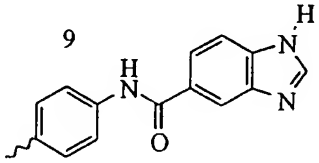
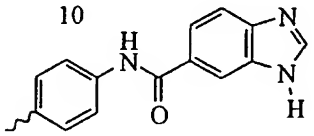
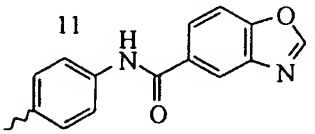
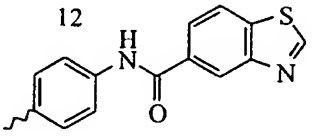
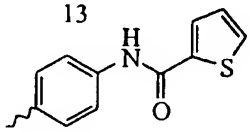
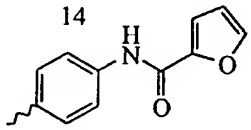
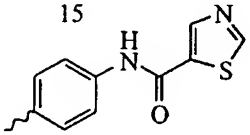
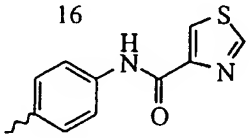
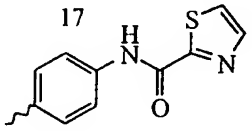
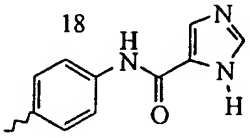


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	

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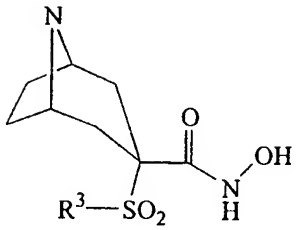

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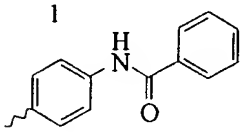
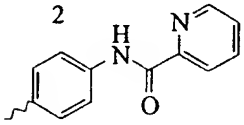
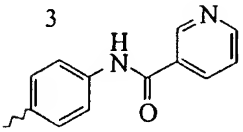
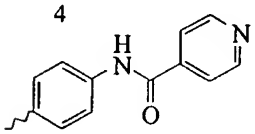
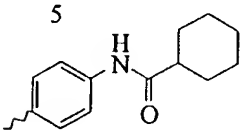
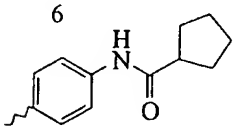
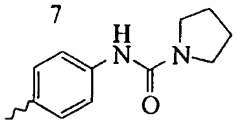
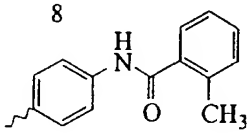
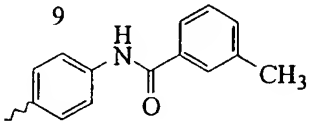
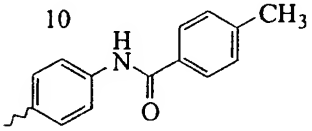
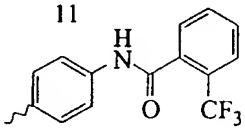
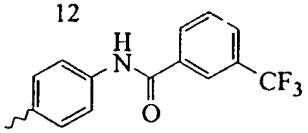
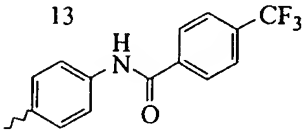
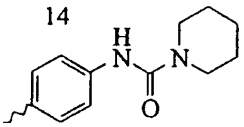
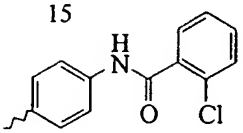
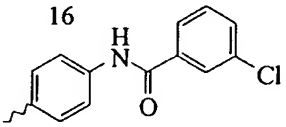
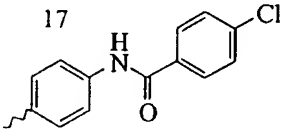
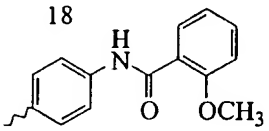
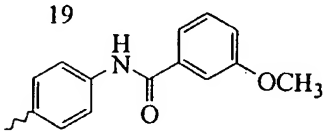
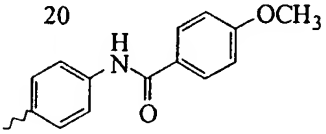
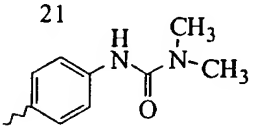
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

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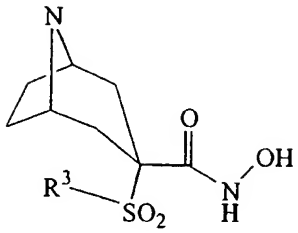


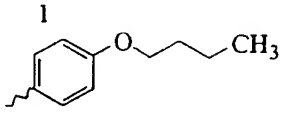
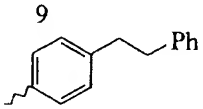
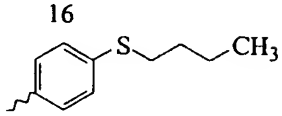
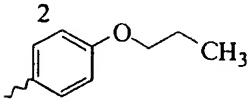
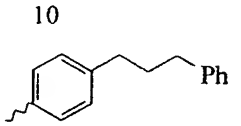
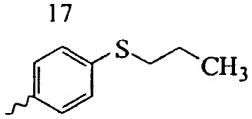
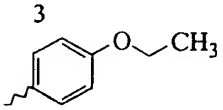
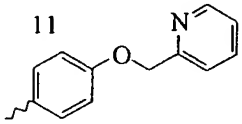
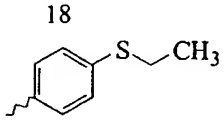
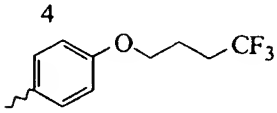
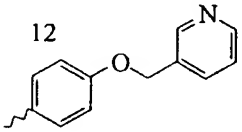
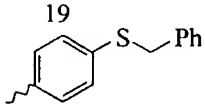
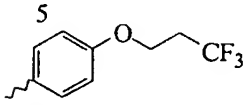
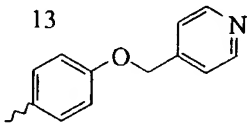
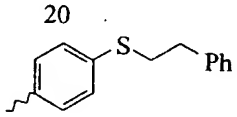
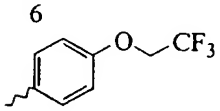
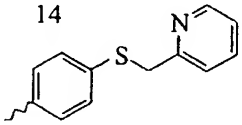
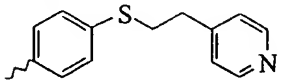
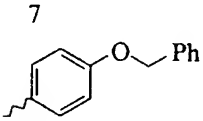
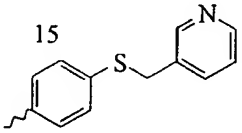
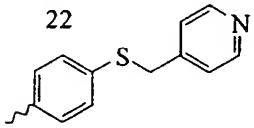
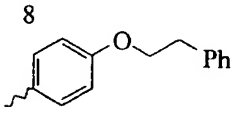
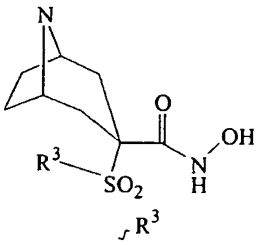
1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

Table 82



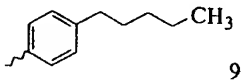
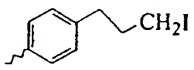
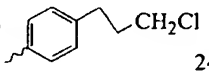
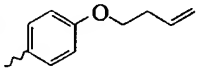
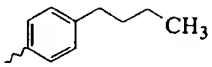
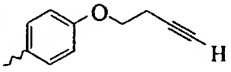
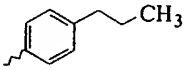
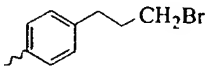
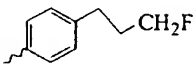
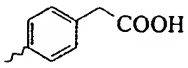
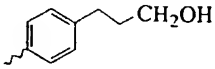
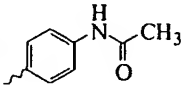
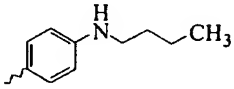
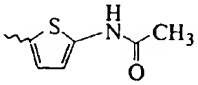
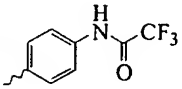
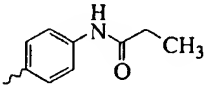
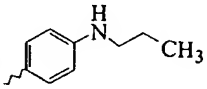
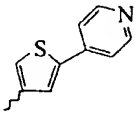
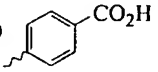
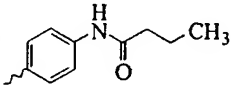
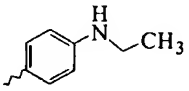
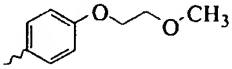
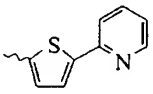
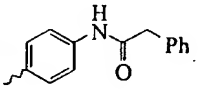
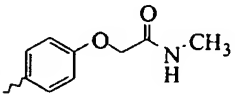
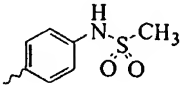
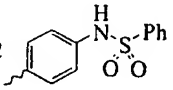
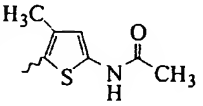
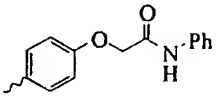
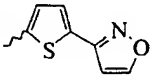
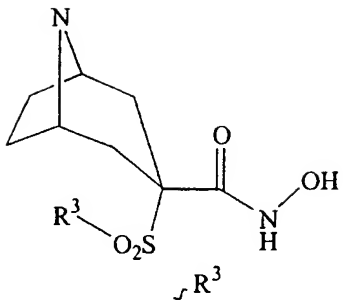
1 	9 	17 	23 
2 			24 
3 	10 	18 	
4 	11 		25 
5 	12 	19 	26 
6 	13 	20 	27 
7 	14 	21 	28 
8 	15 	22 	29 
	16 		30 

Table 83



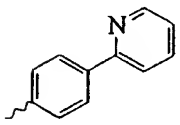
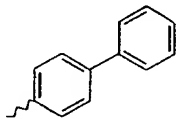
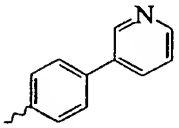
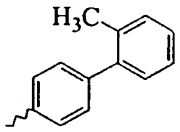
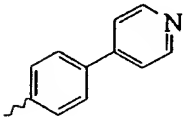
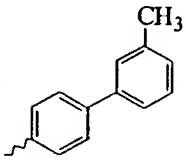
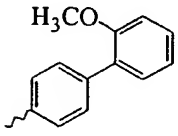
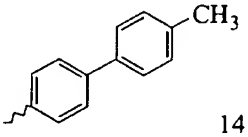
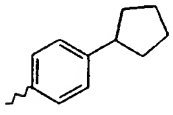
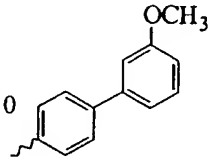
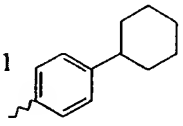
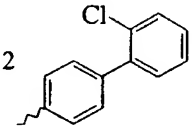
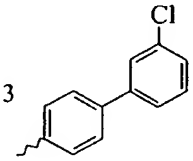
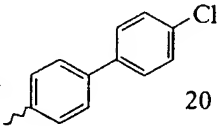
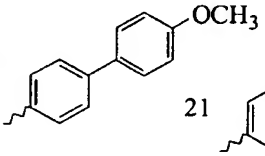
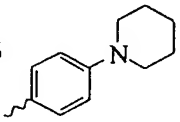
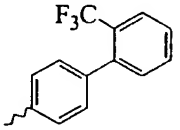
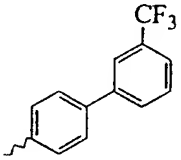
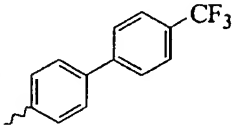
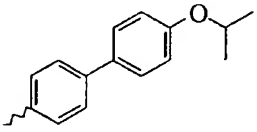
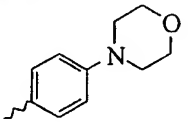
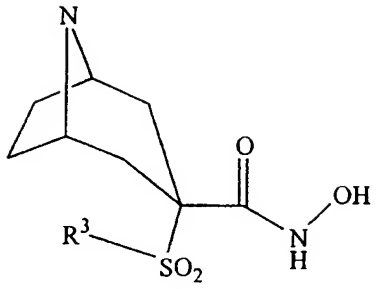
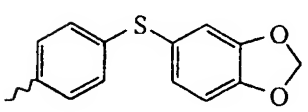
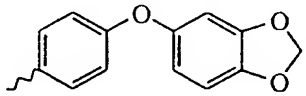
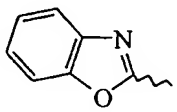
1		6	
2		7	
3		8	
4		9	
5		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	
		21	

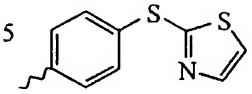
Table 84

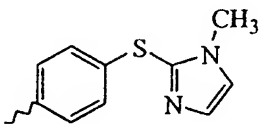


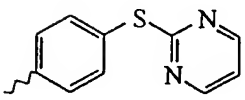
1 

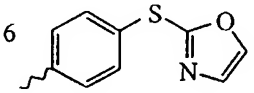
8 

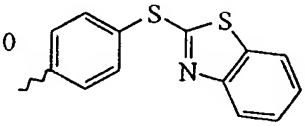
2 

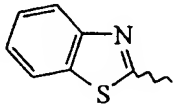
5 

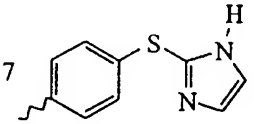
9 

3 

6 

10 

4 

7 

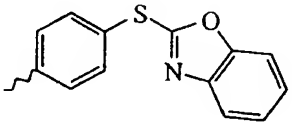
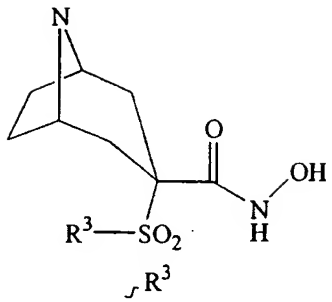
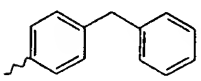
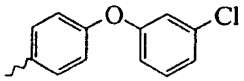
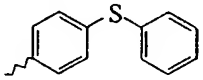
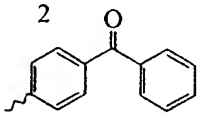
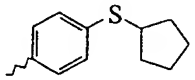
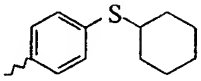
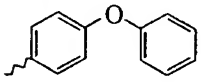
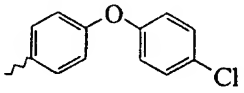
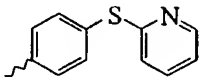
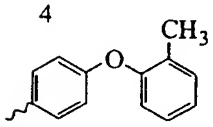
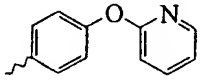
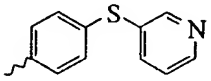
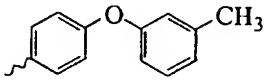
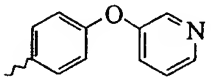
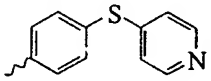
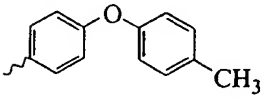
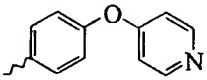
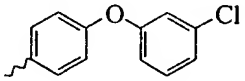
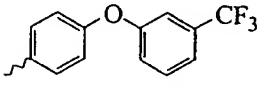
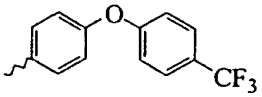
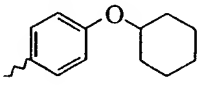
11 

Table 85



1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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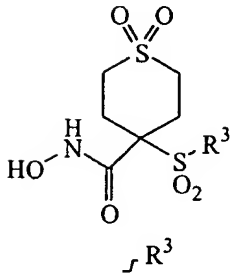


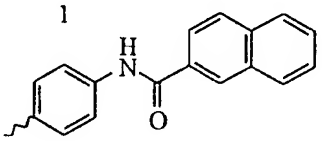
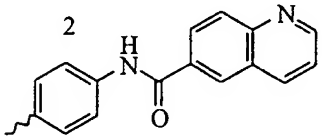
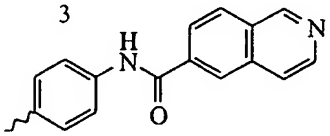
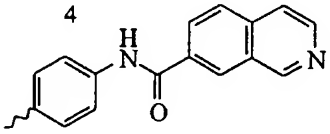
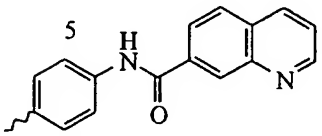
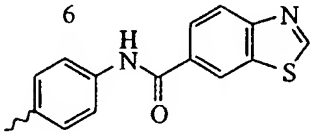
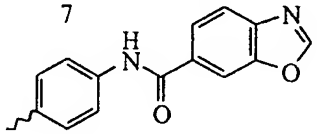
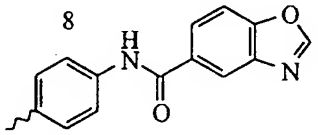
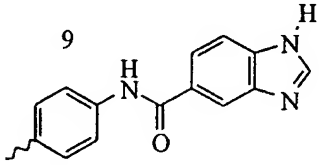
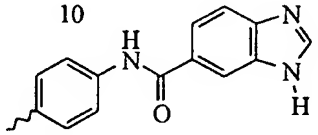
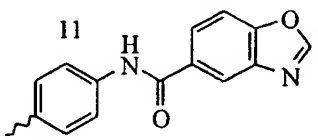
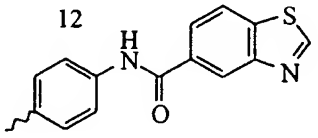
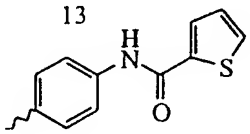
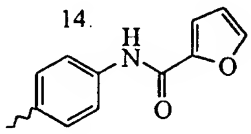
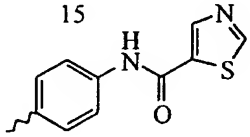
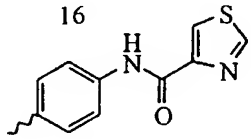
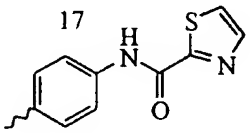
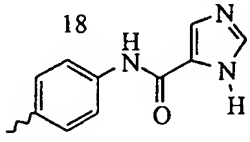
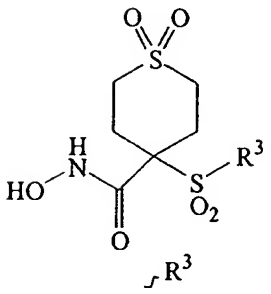
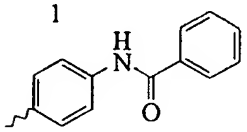
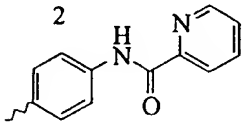
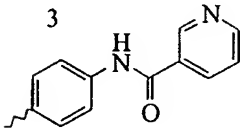
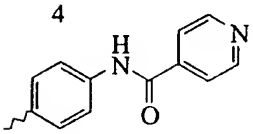
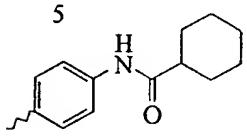
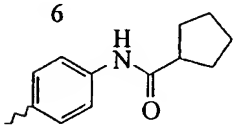
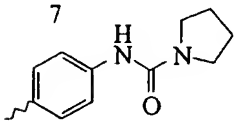
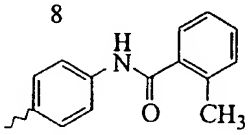
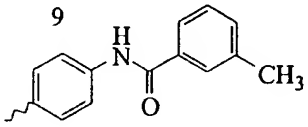
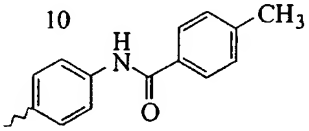
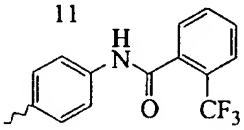
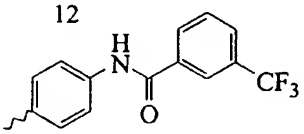
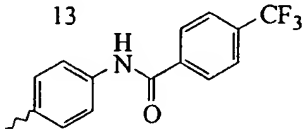
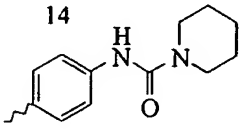
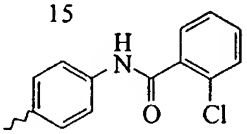
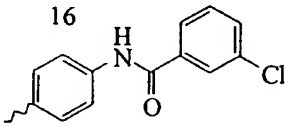
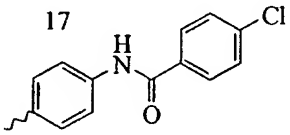
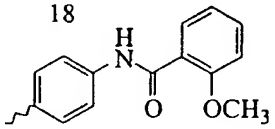
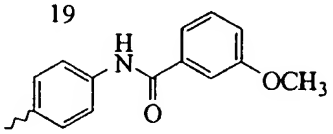
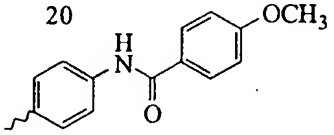
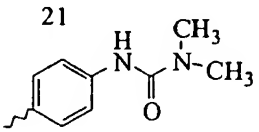
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	

Table 87



1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

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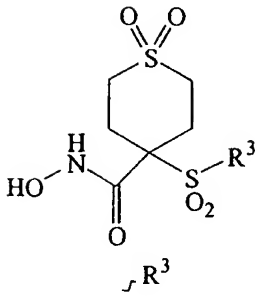


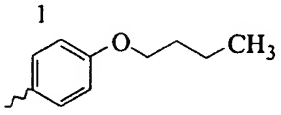
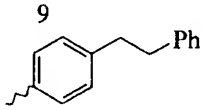
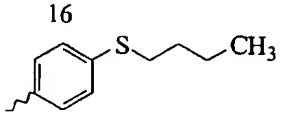
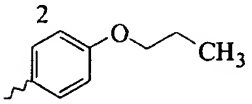
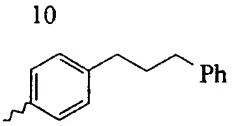
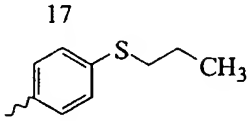
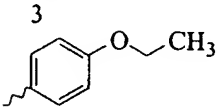
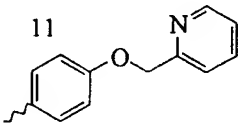
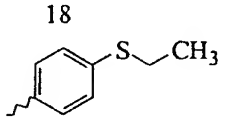
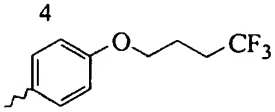
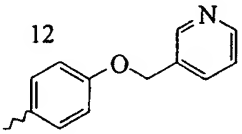
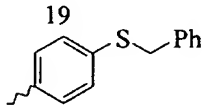
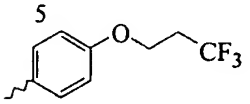
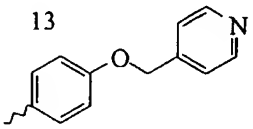
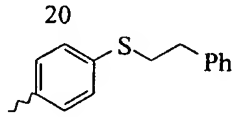
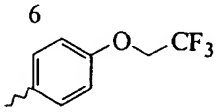
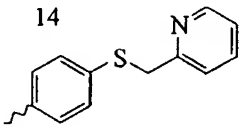
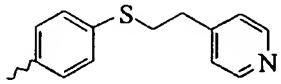
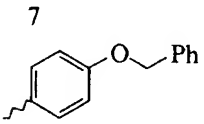
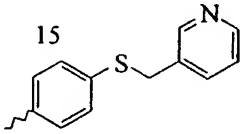
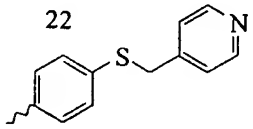
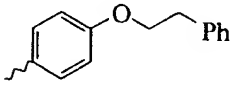
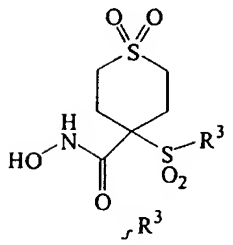
1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

Table 89



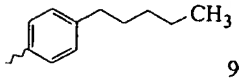
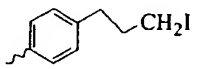
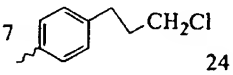
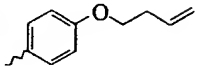
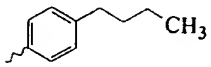
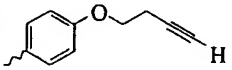
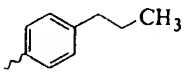
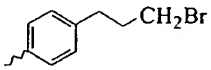
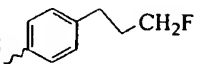
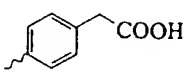
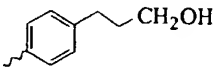
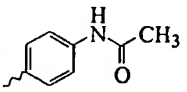
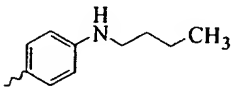
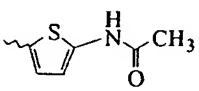
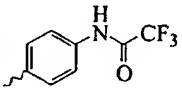
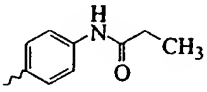
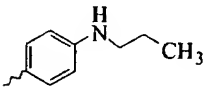
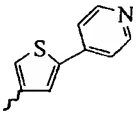
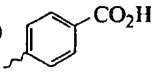
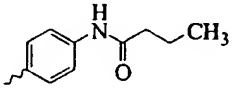
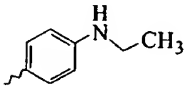
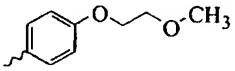
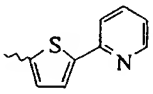
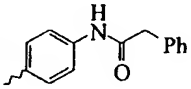
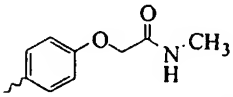
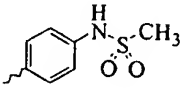
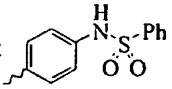
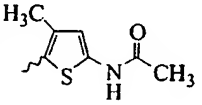
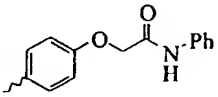
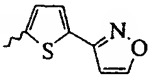
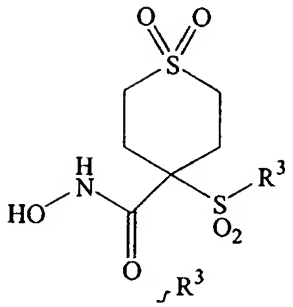
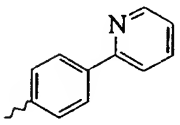
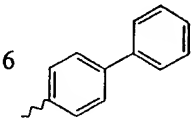
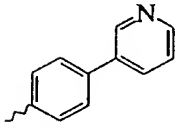
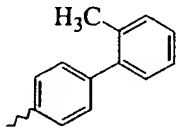
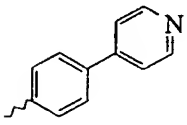
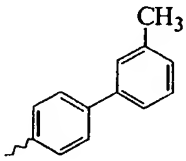
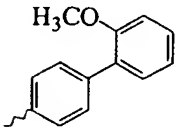
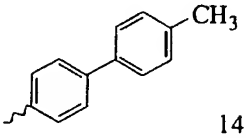
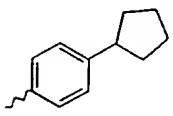
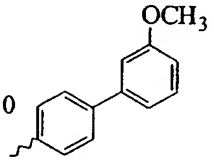
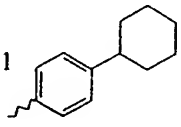
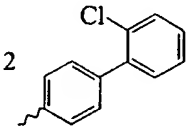
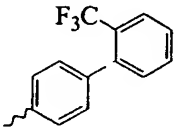
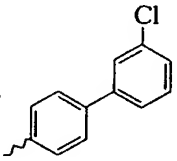
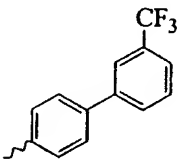
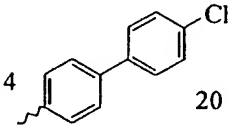
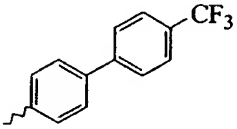
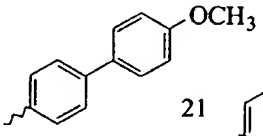
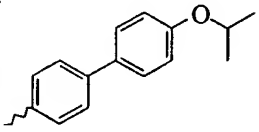
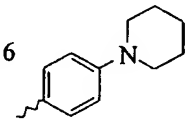
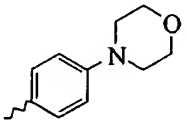
1		9		17		23	
2						24	
3		10		18			
4		11				25	
5		12		19		26	
6		13		20		27	
7		14		21		28	
8		15		22		29	
		16				30	

Table 90



1		6	
2		7	
3		8	
4		9	
5		10	
		11	
12		17	
13		18	
14		19	
15		20	
16		21	

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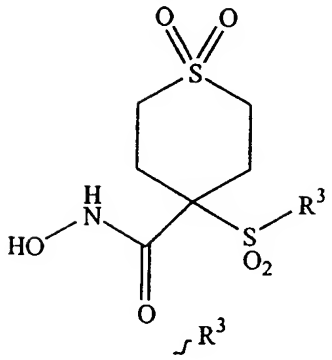
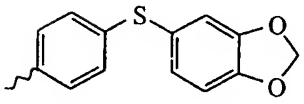
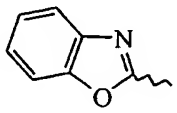
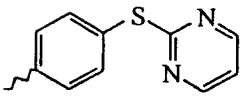
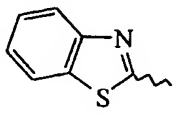
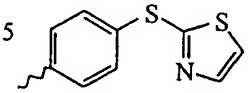
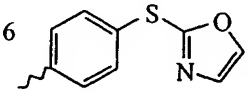
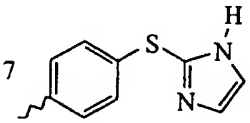
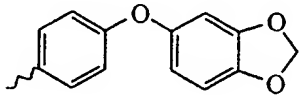
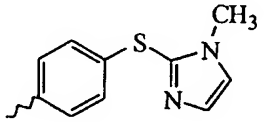
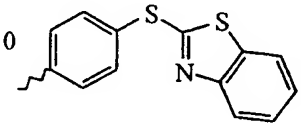
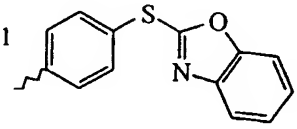


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

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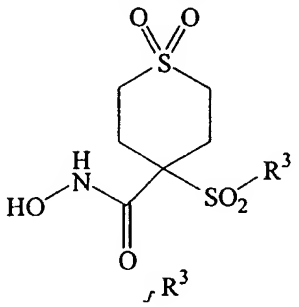
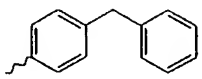
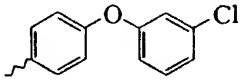
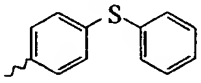
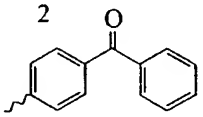
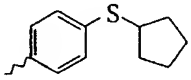
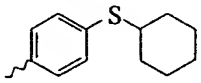
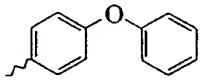
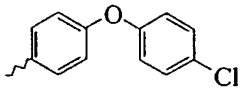
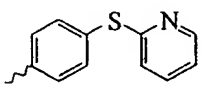
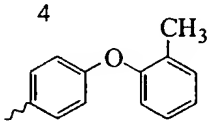
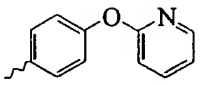
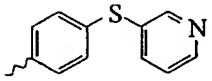
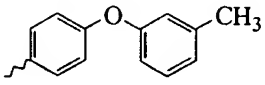
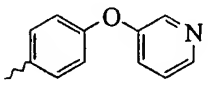
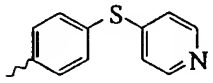
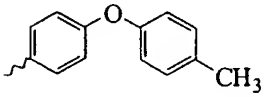
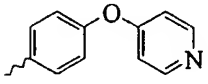
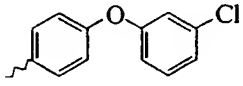
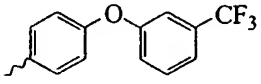
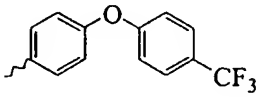
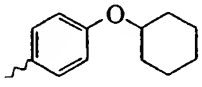


1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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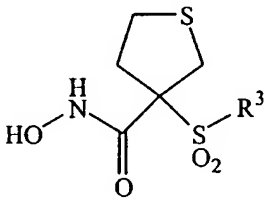


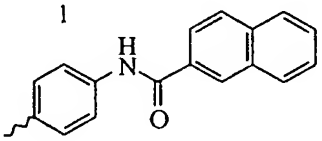
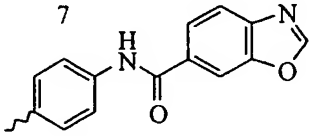
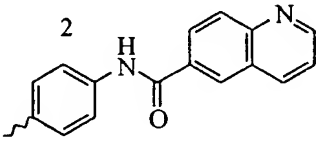
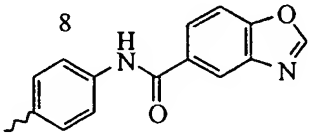
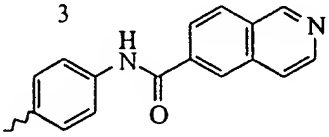
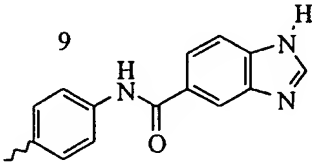
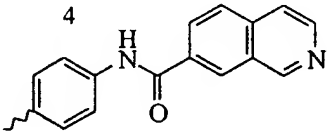
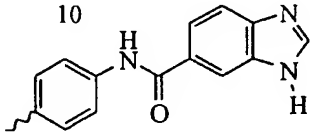
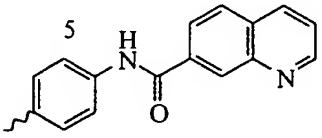
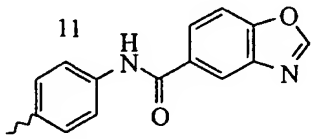
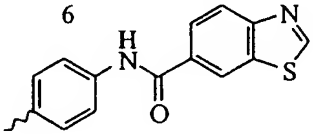
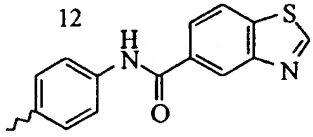
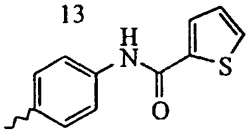
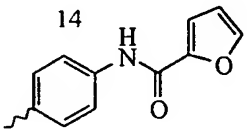
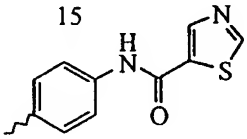
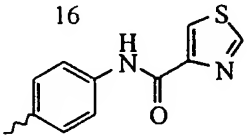
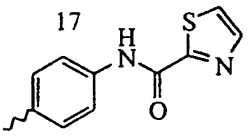
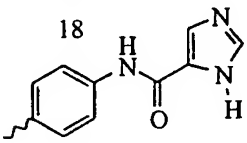
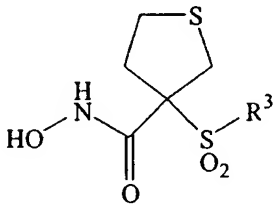
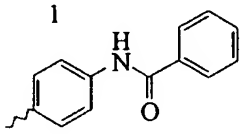
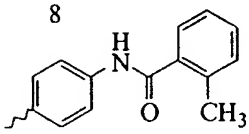
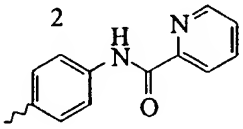
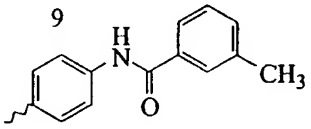
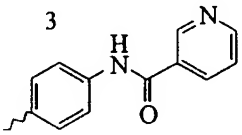
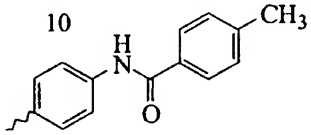
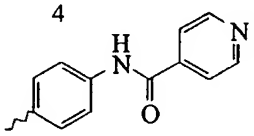
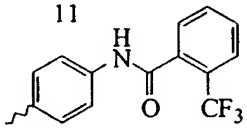
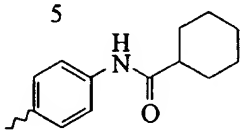
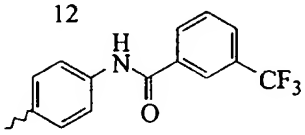
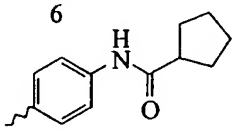
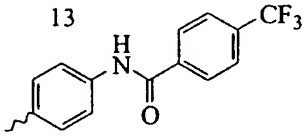
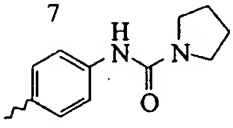
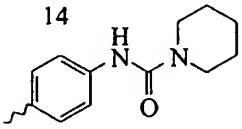
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	
13			
14			
15			
16			
17			
18			

Table 94



R^3

1 	8 
2 	9 
3 	10 
4 	11 
5 	12 
6 	13 
7 	14 

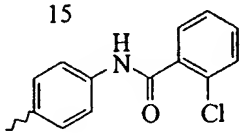
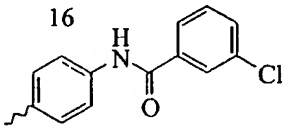
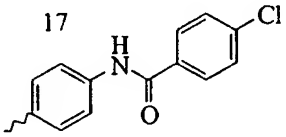
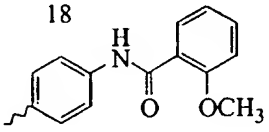
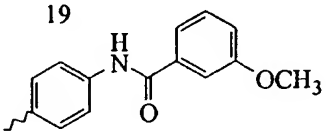
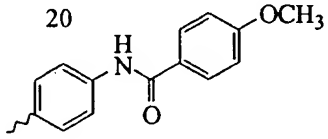
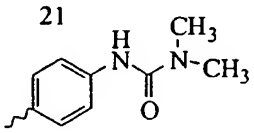
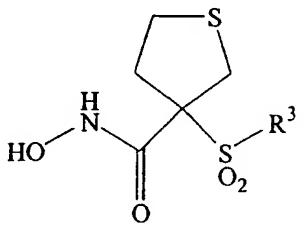
15 
16 
17 
18 
19 
20 
21 

Table 95



R^3

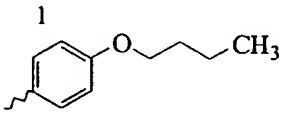
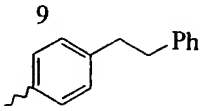
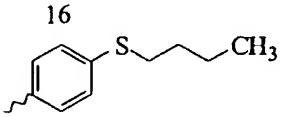
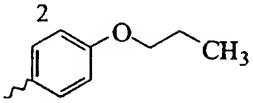
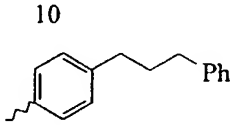
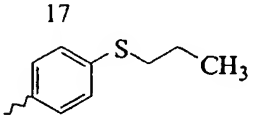
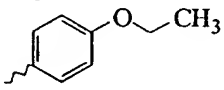
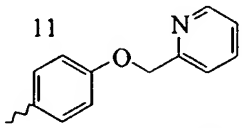
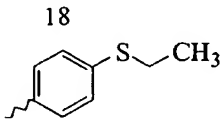
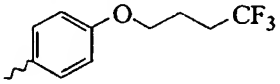
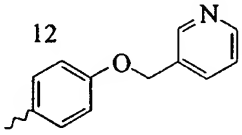
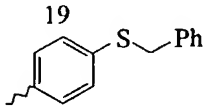
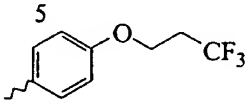
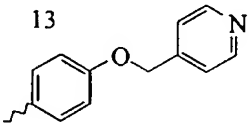
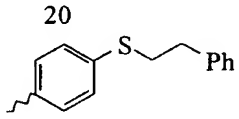
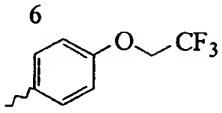
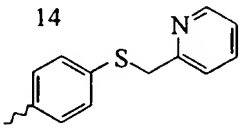
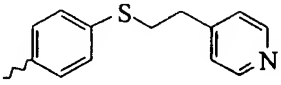
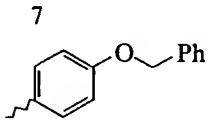
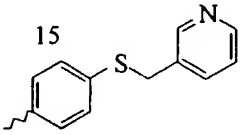
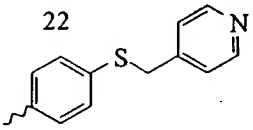
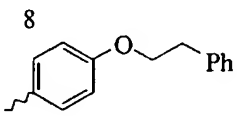
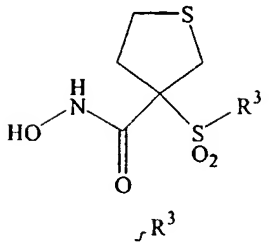
1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

Table 96



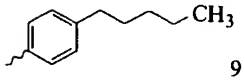
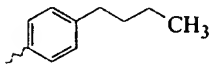
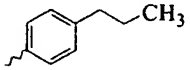
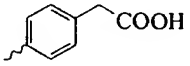
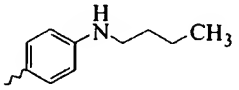
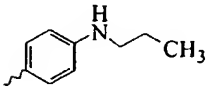
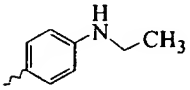
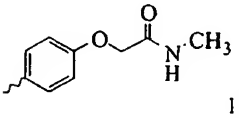
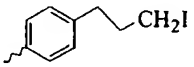
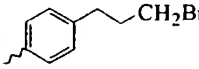
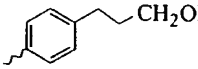
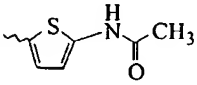
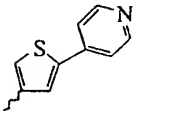
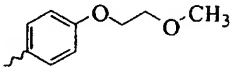
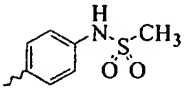
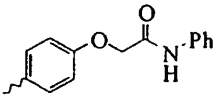
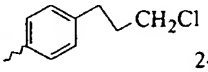
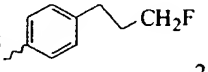
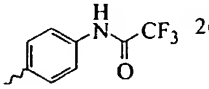
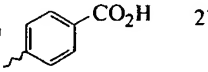
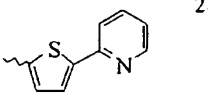
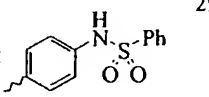
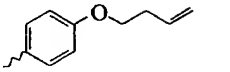
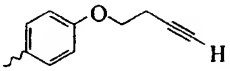
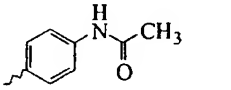
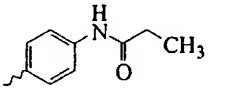
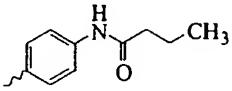
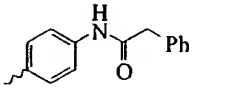
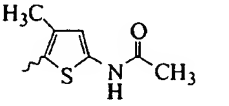
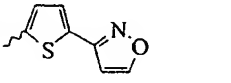
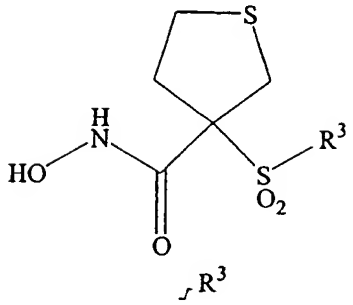
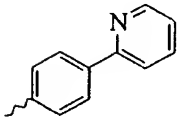
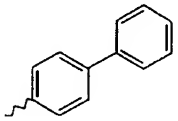
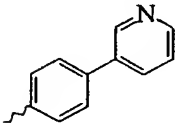
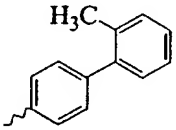
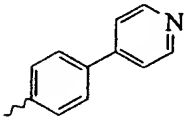
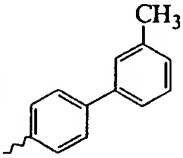
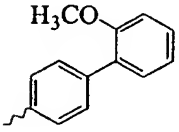
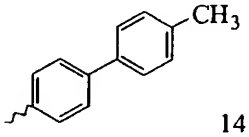
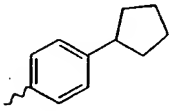
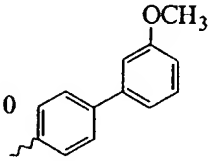
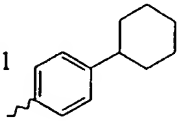
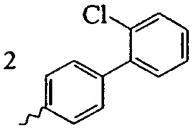
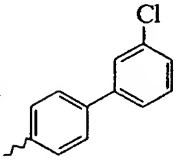
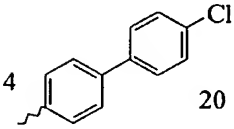
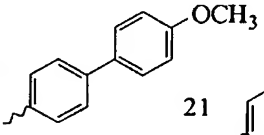
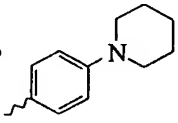
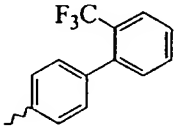
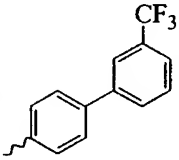
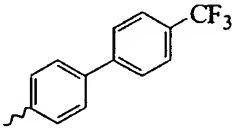
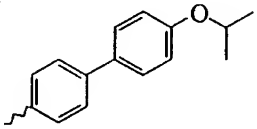
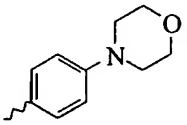
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Table 97



1		6	
2		7	
3		8	
4		9	
5		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	
		21	

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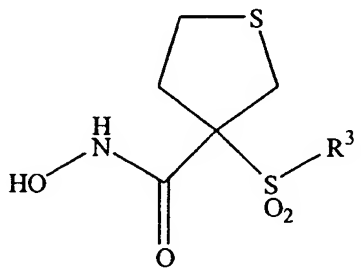
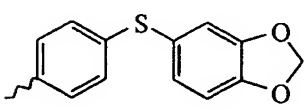
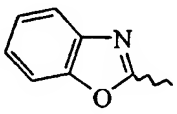
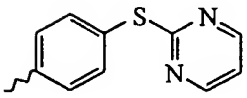
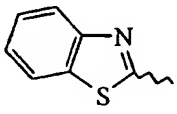
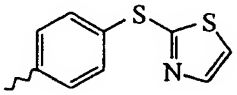
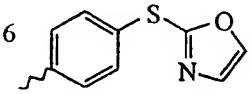
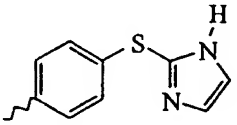
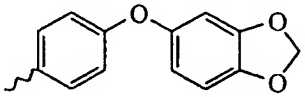
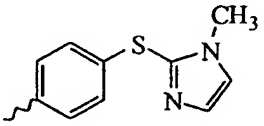
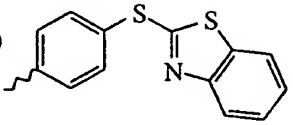
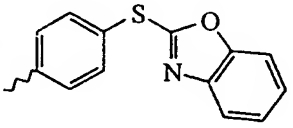


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

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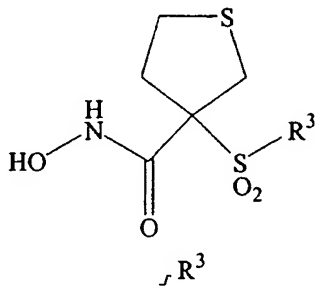
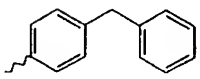
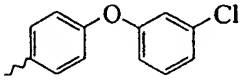
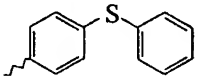
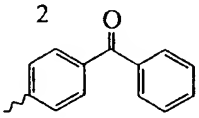
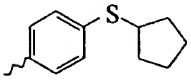
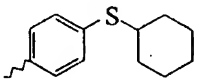
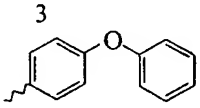
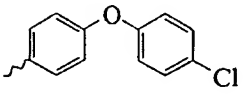
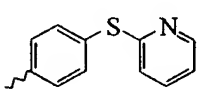
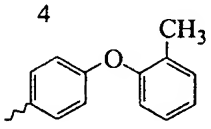
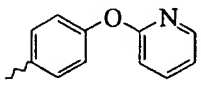
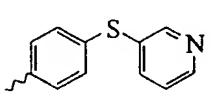
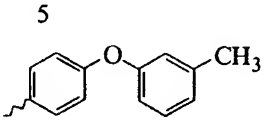
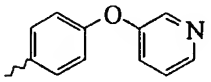
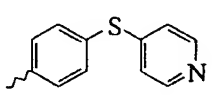
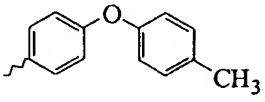
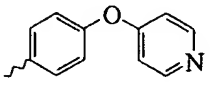
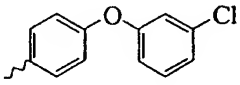
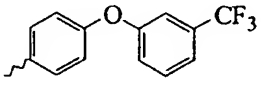
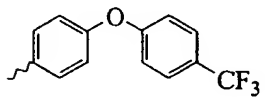
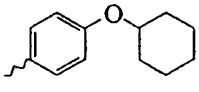


1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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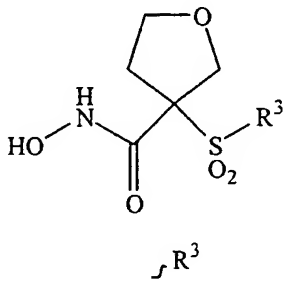


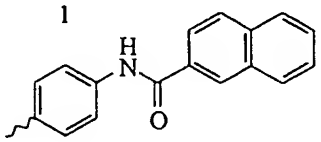
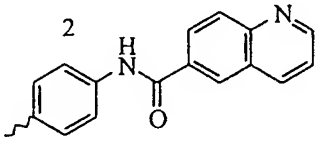
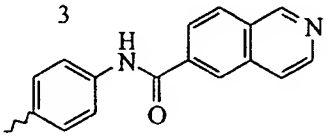
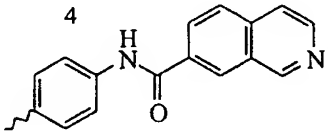
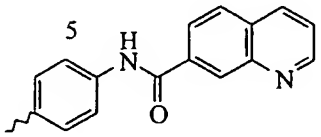
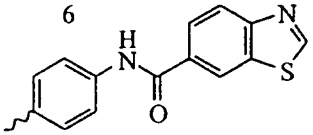
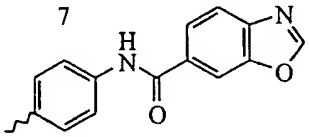
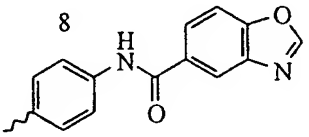
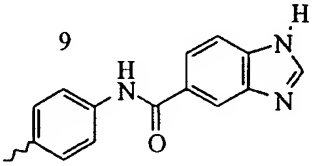
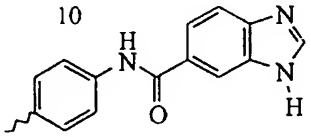
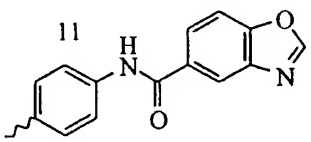
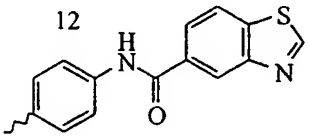
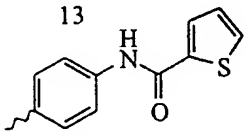
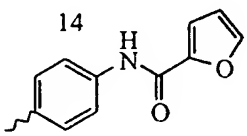
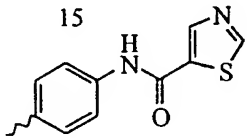
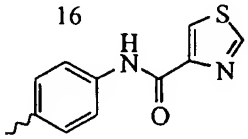
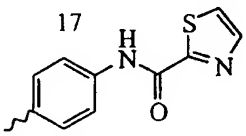
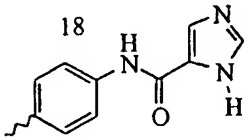
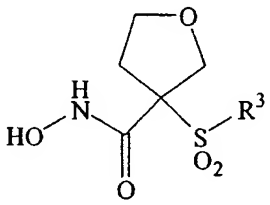
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	

Table 101



R^3

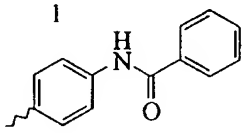
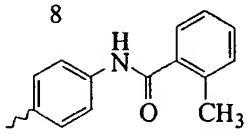
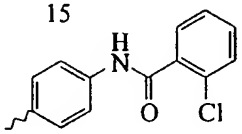
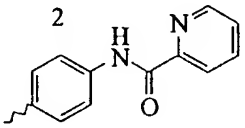
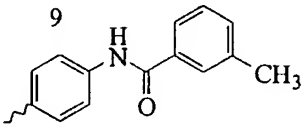
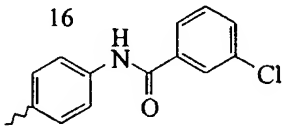
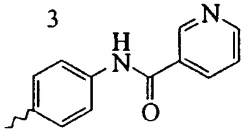
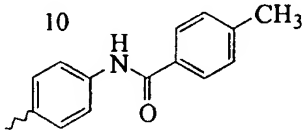
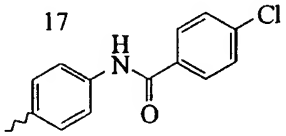
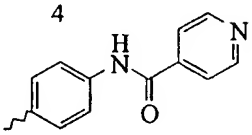
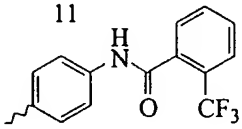
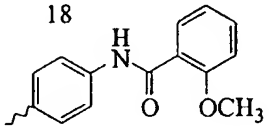
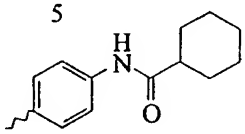
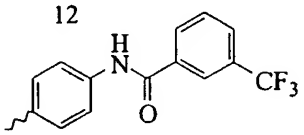
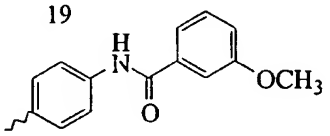
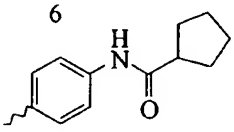
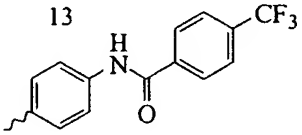
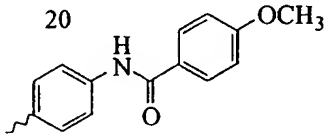
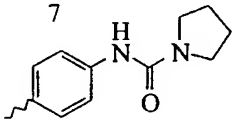
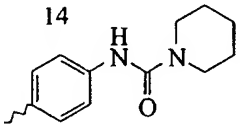
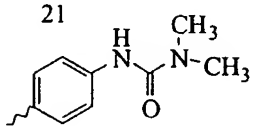
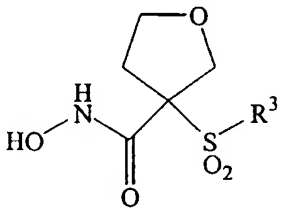
1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

Table 102



R^3

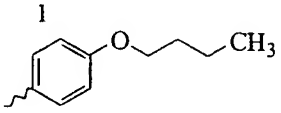
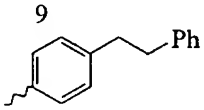
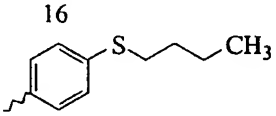
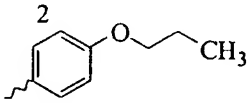
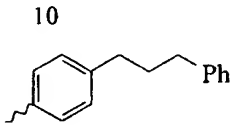
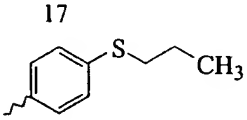
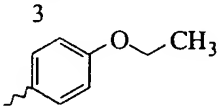
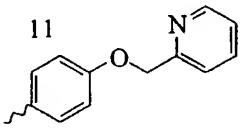
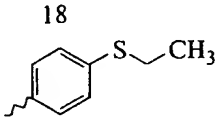
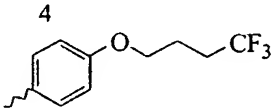
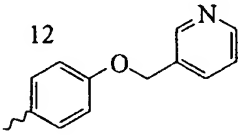
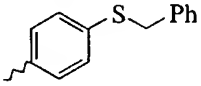
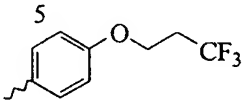
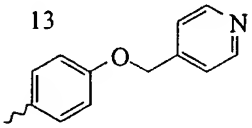
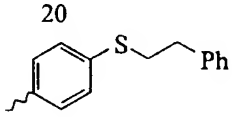
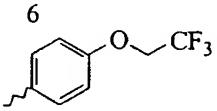
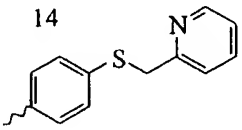
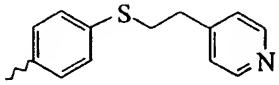
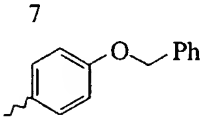
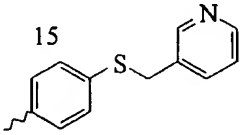
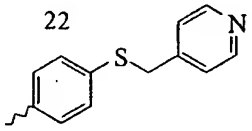
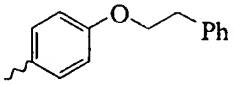
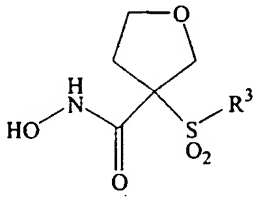
1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

Table 103



R^3

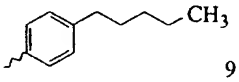
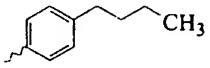
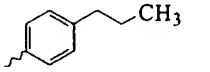
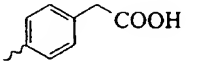
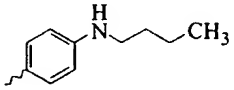
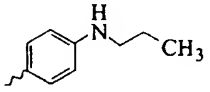
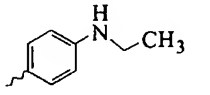
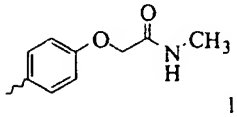
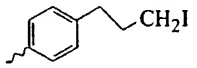
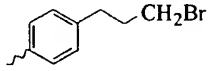
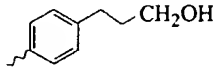
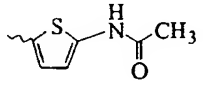
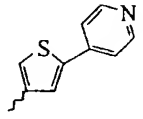
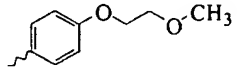
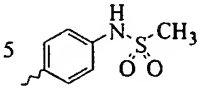
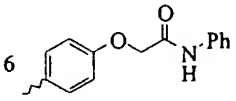
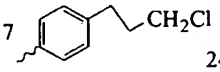
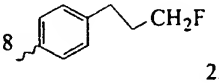
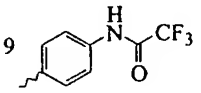
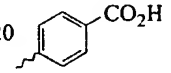
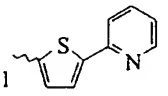
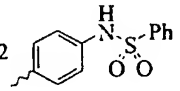
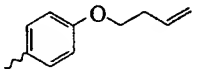
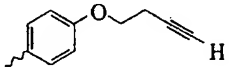
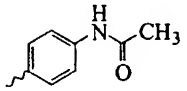
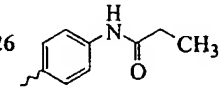
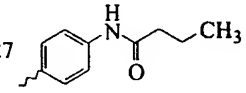
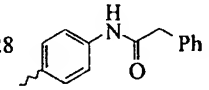
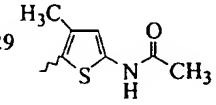
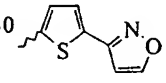
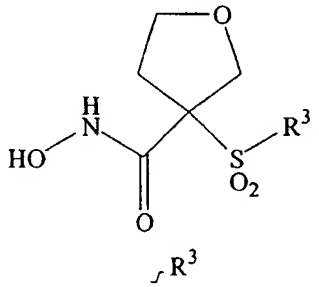
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Table 104



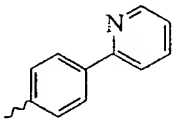
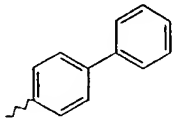
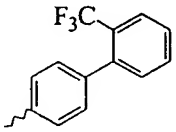
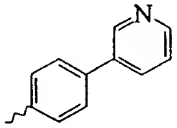
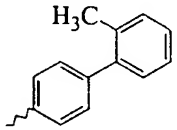
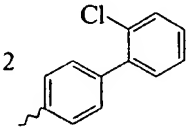
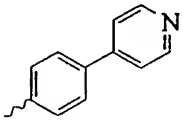
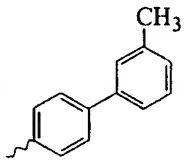
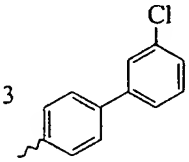
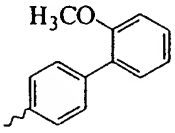
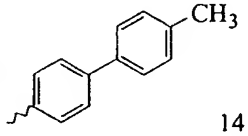
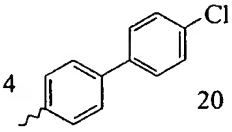
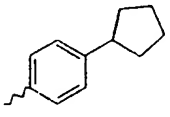
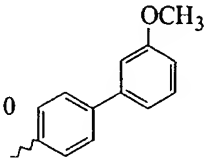
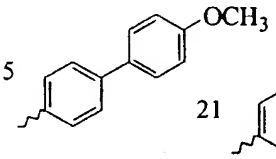
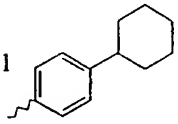
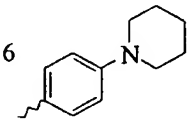
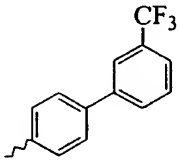
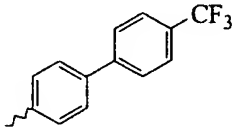
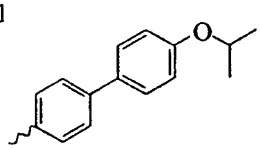
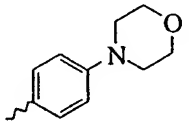
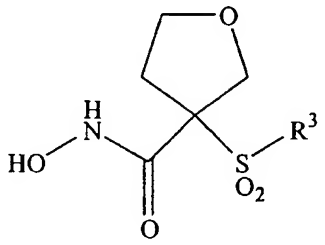
1		6		17	
2		7		12	
3		8		13	
4		9		14	
5		10		15	
		11		16	
				18	
				19	
				20	
				21	

Table 105



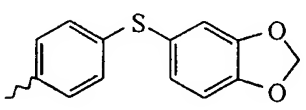
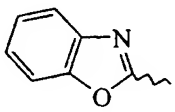
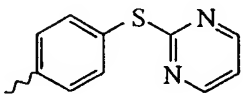
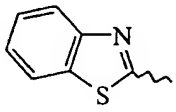
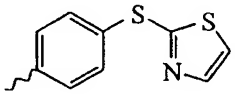
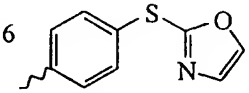
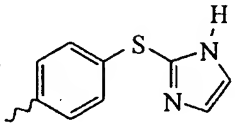
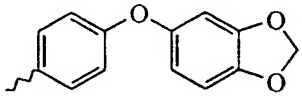
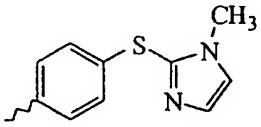
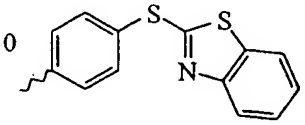
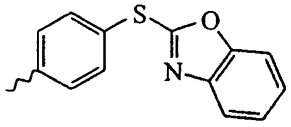
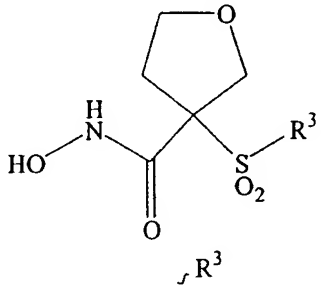
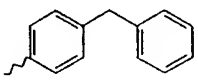
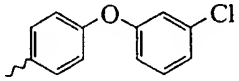
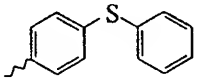
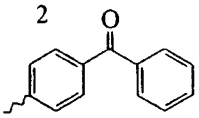
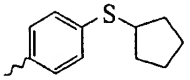
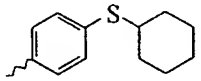
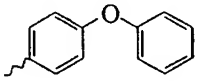
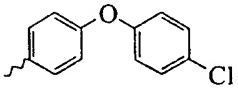
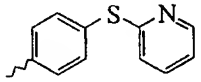
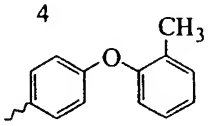
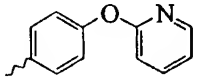
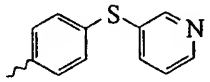
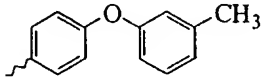
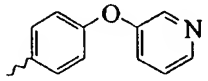
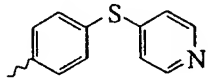
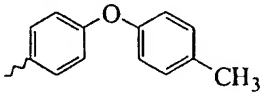
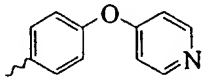
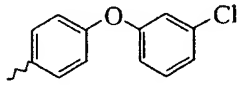
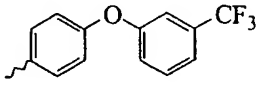
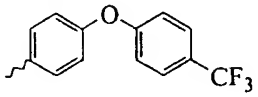
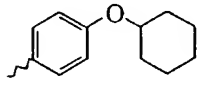
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Table 106



1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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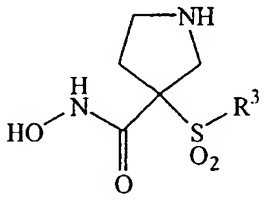


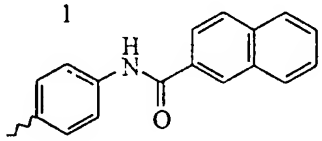
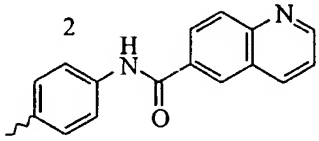
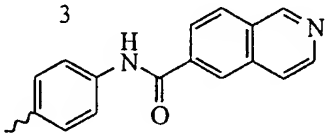
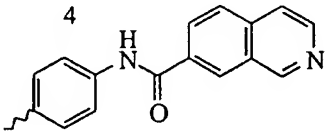
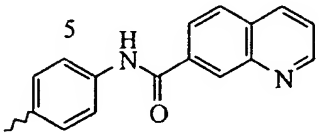
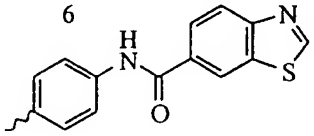
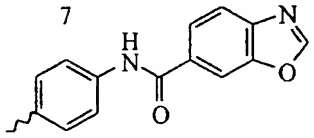
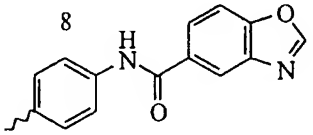
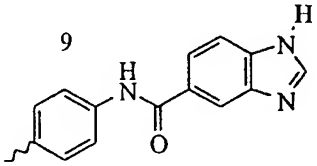
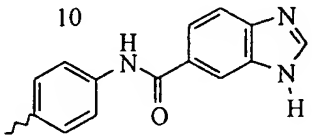
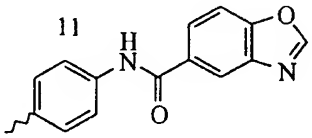
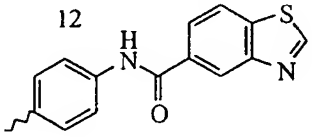
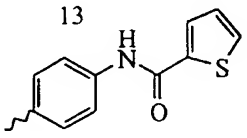
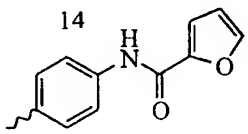
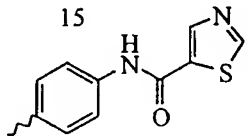
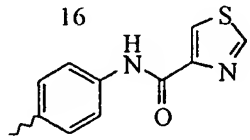
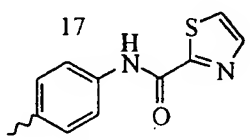
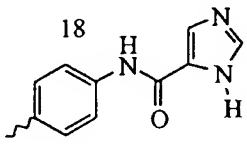
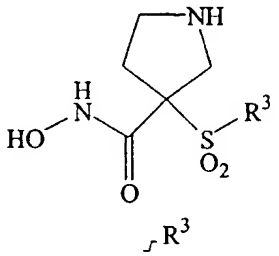
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	

Table 108



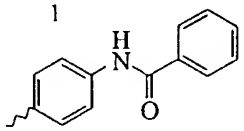
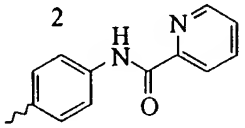
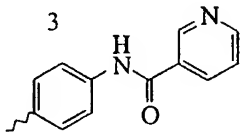
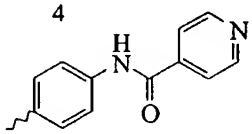
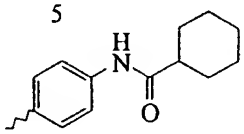
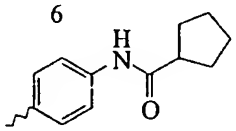
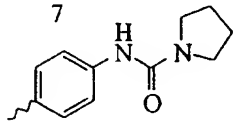
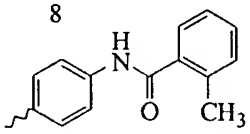
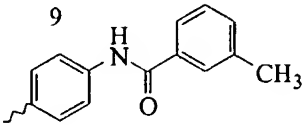
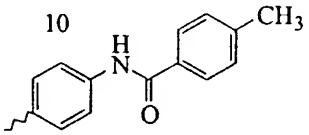
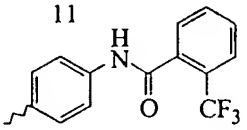
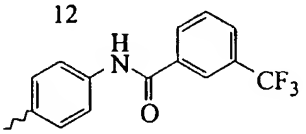
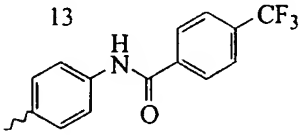
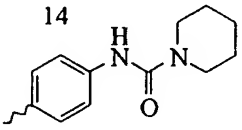
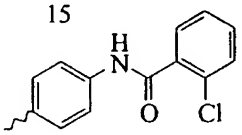
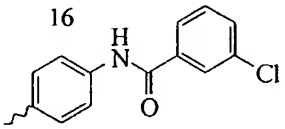
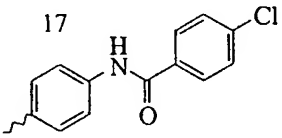
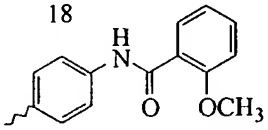
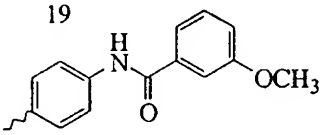
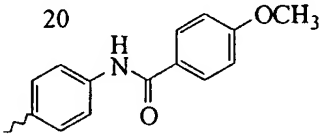
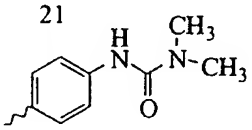
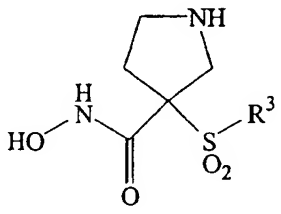
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

Table 109



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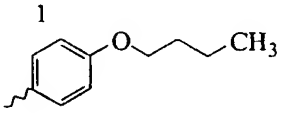
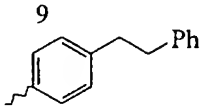
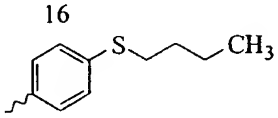
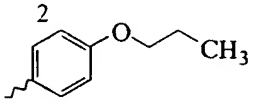
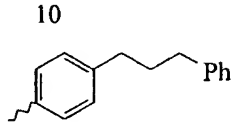
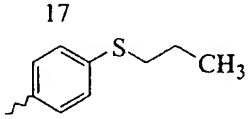
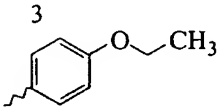
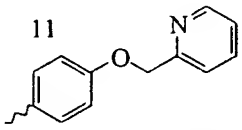
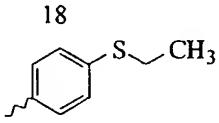
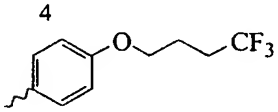
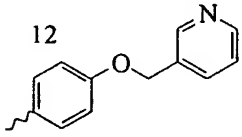
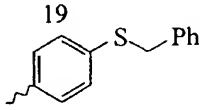
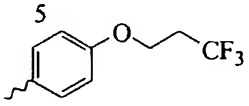
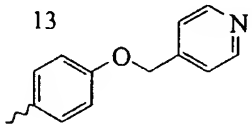
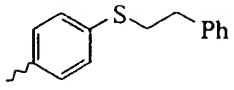
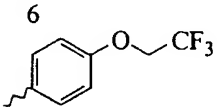
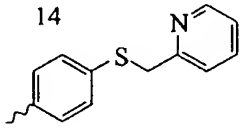
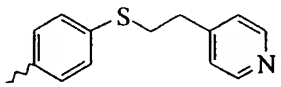
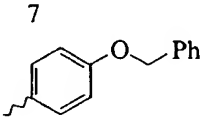
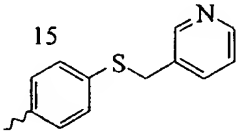
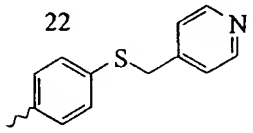
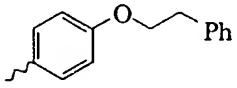
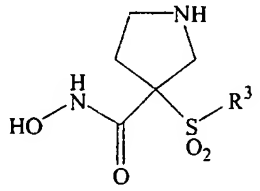
1 	9 	16 
2 	10 	17 
3 	11 	18 
4 	12 	19 
5 	13 	20 
6 	14 	21 
7 	15 	22 
8 		

Table 110



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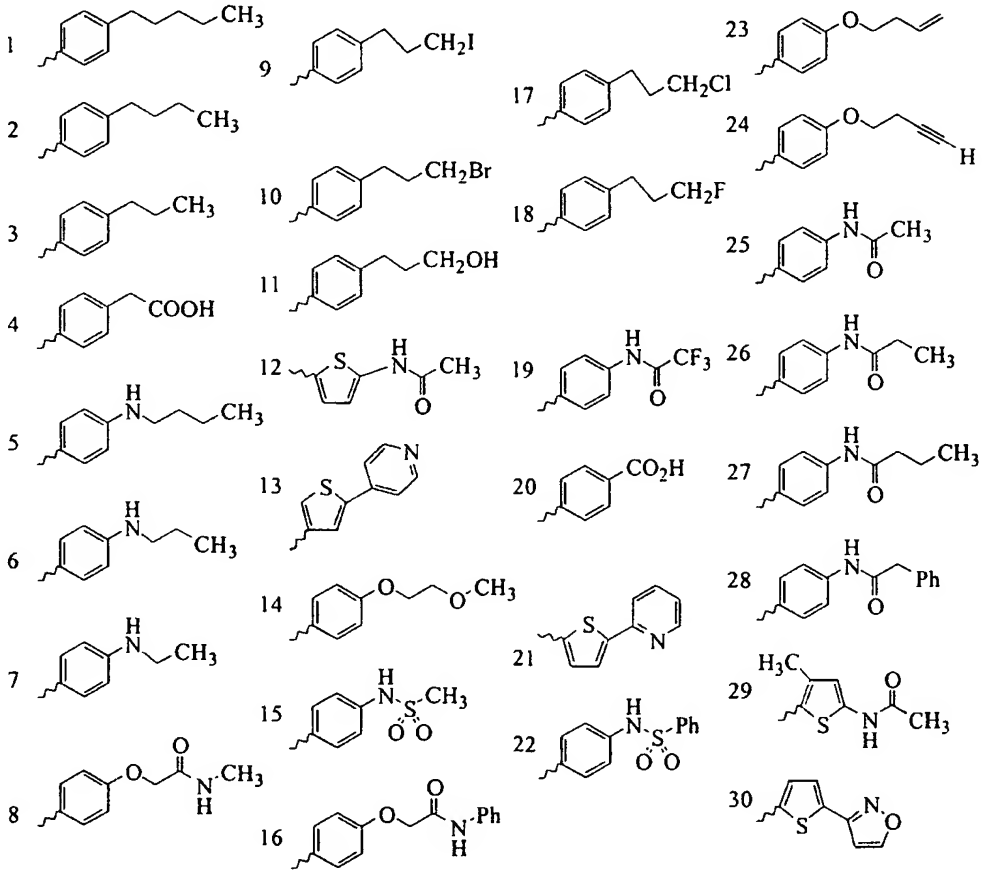
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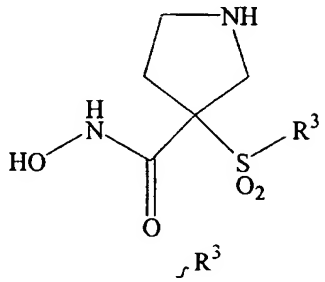
Table 111



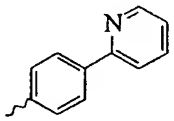
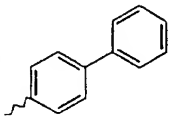
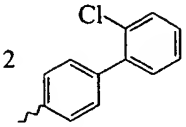
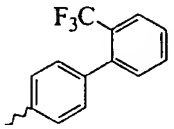
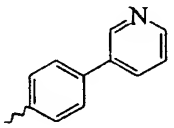
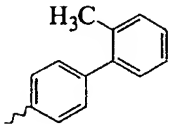
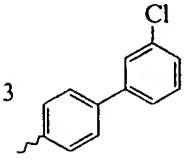
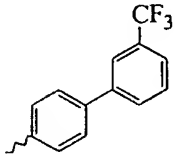
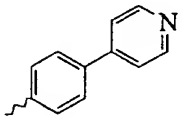
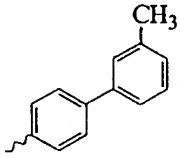
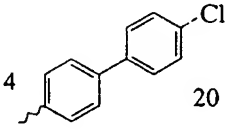
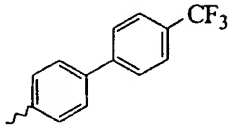
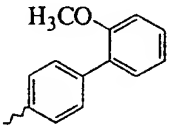
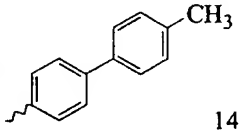
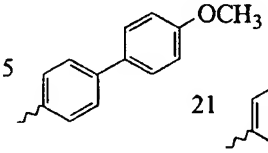
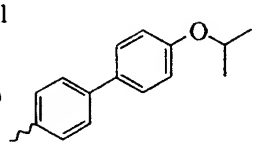
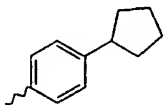
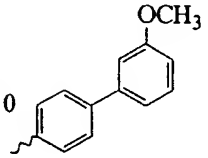
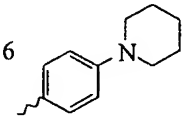
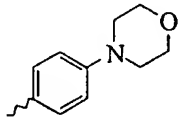
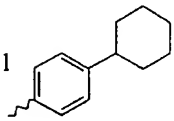
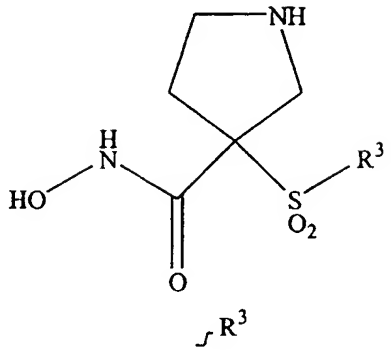
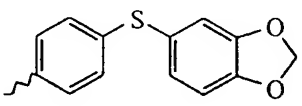
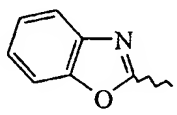
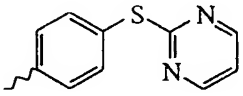
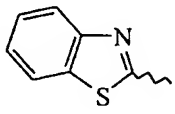
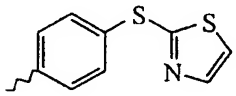
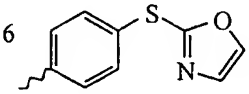
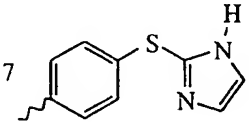
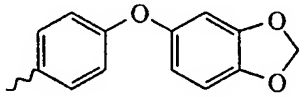
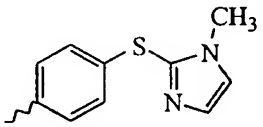
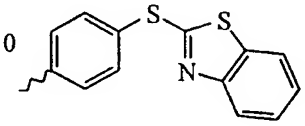
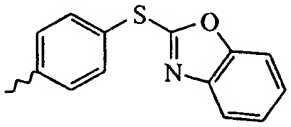
1 	6 	12 	17 
2 	7 	13 	18 
3 	8 	14 	19 
4 	9 	15 	20 
5 	10 	16 	21 
	11 		

Table 112



1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

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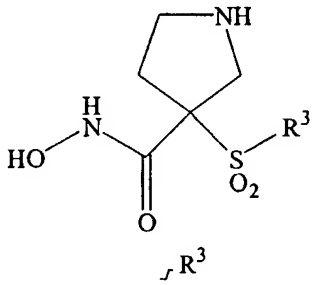
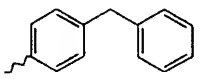
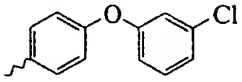
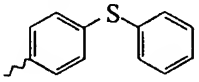
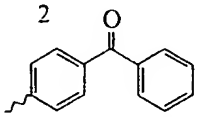
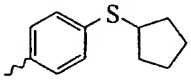
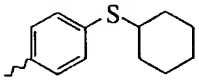
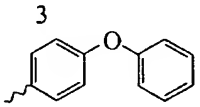
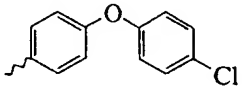
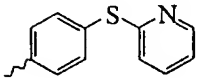
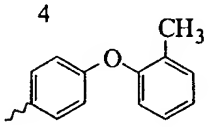
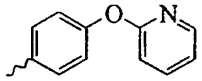
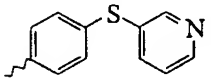
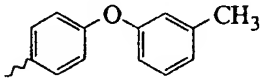
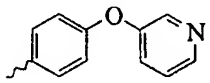
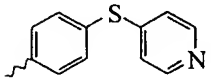
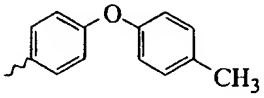
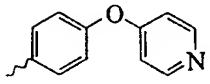
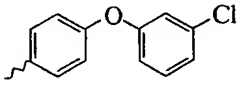
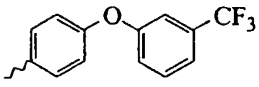
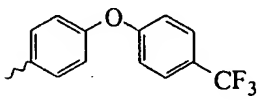
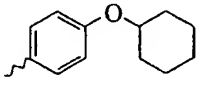


1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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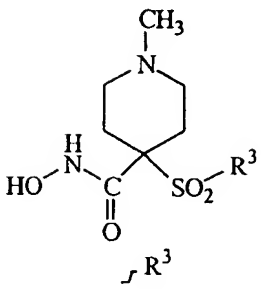


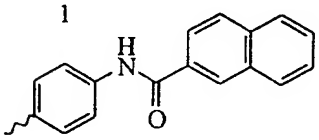
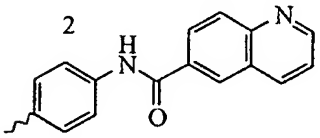
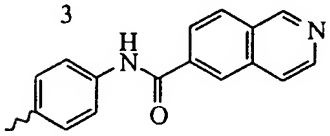
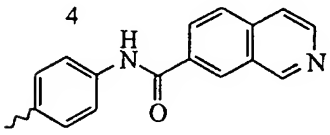
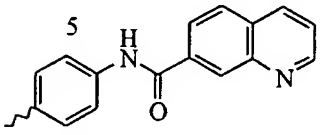
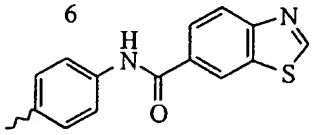
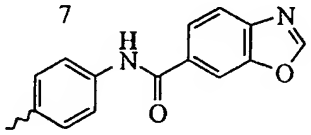
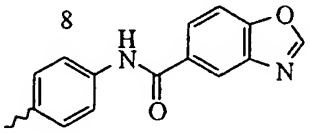
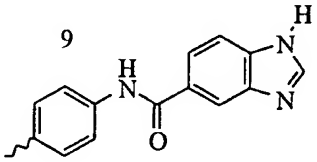
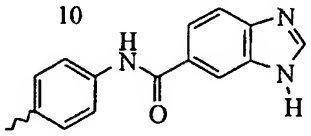
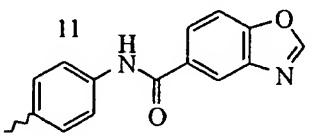
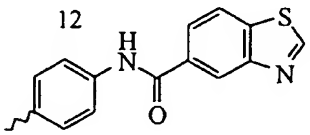
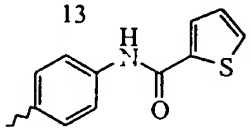
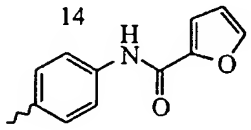
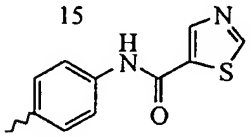
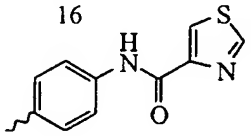
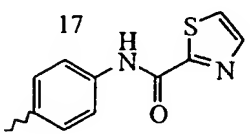
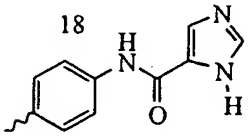
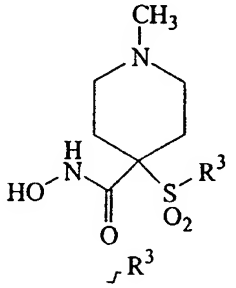
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	

Table 115



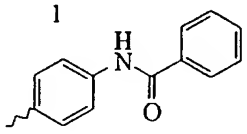
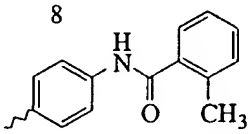
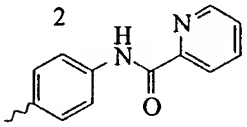
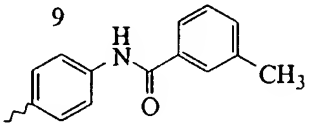
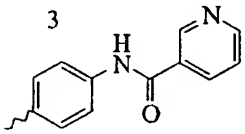
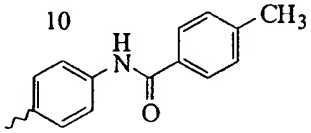
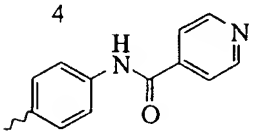
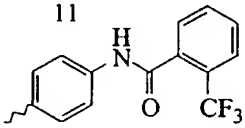
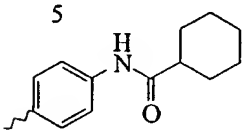
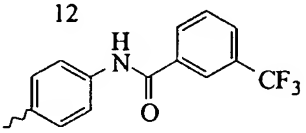
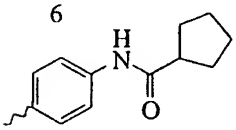
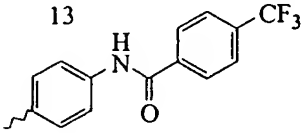
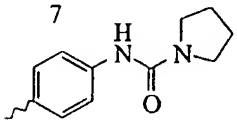
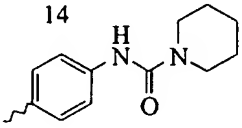
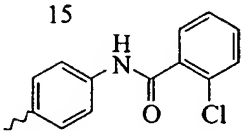
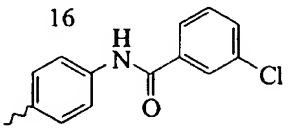
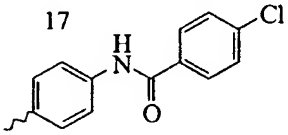
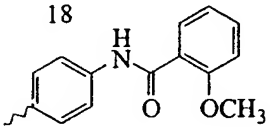
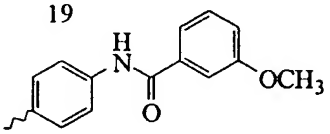
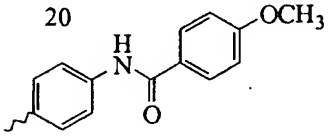
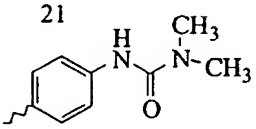
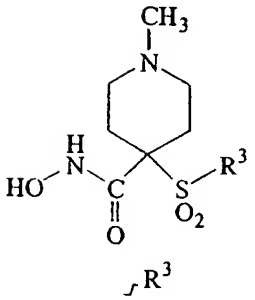
1 	8 
2 	9 
3 	10 
4 	11 
5 	12 
6 	13 
7 	14 
15 	
16 	
17 	
18 	
19 	
20 	
21 	

Table 116



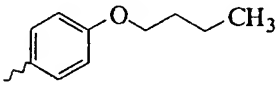
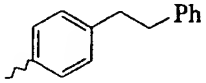
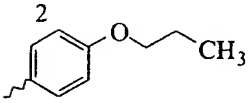
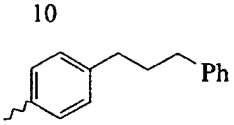
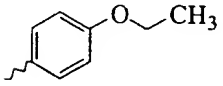
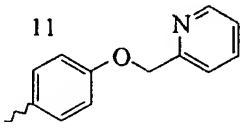
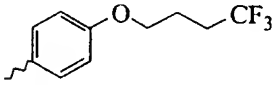
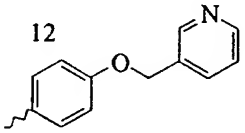
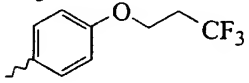
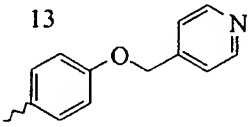
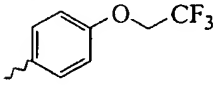
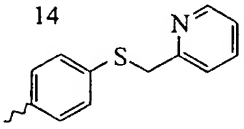
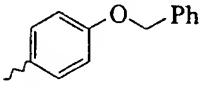
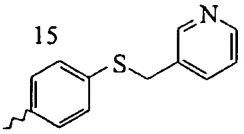
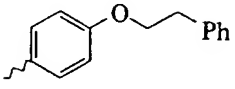
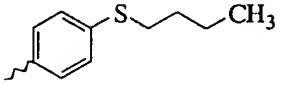
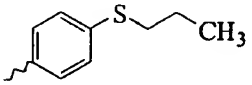
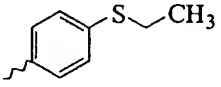
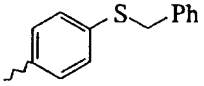
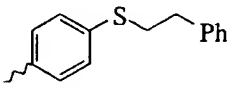
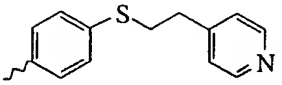
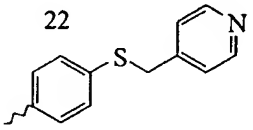
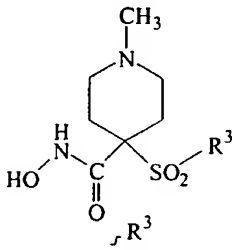
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8		16	
		17	
		18	
		19	
		20	
		21	
		22	

Table 117



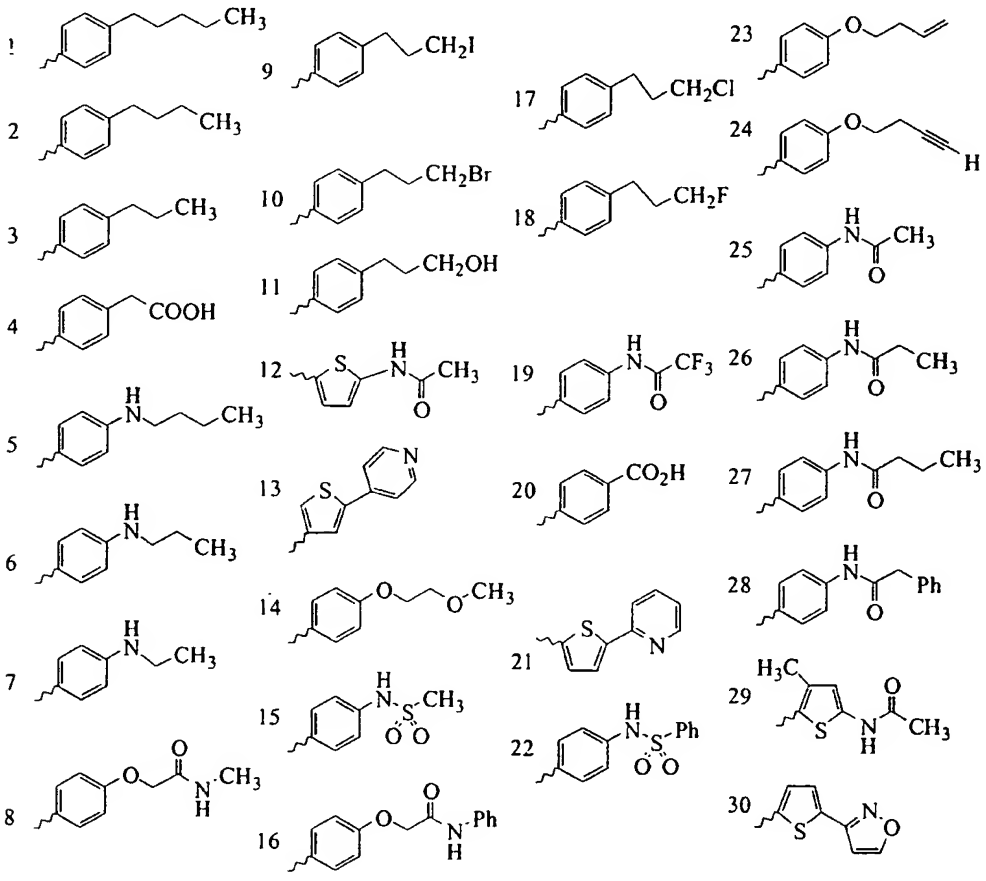

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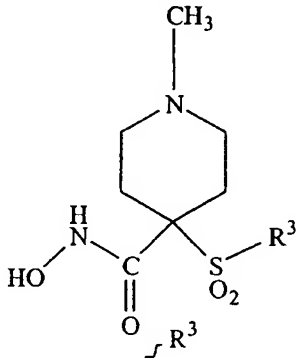
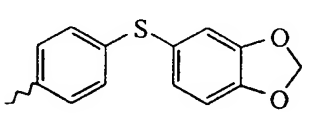
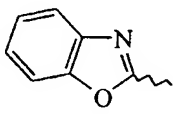
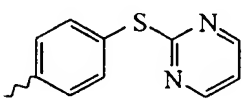
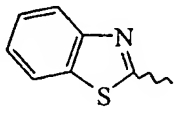
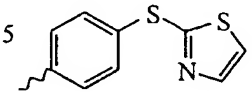
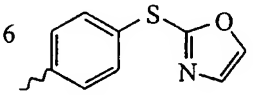
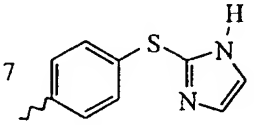
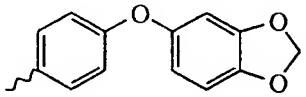
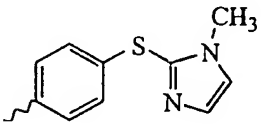
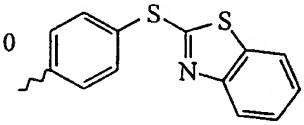
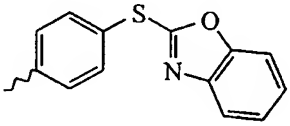
Table 118



1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

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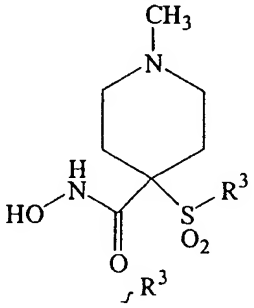
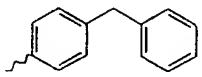
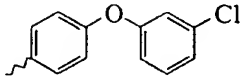
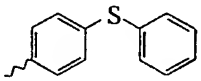
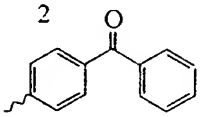
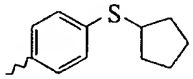
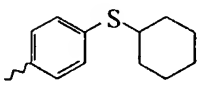
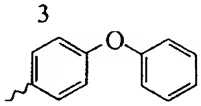
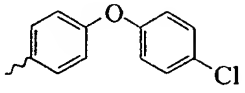
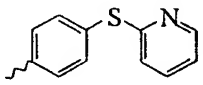
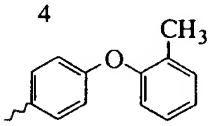
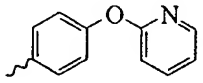
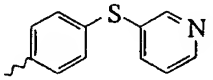
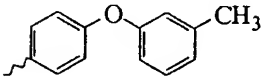
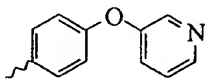
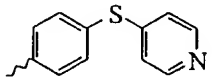
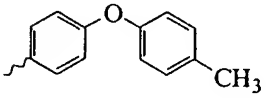
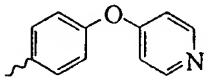
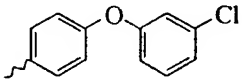
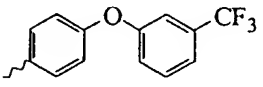
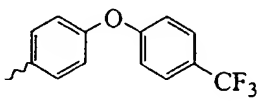
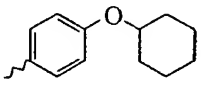


1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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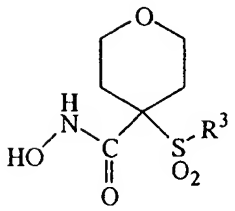
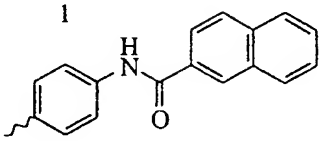
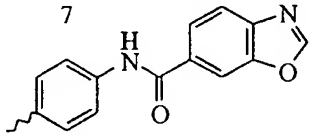
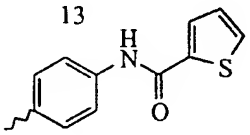
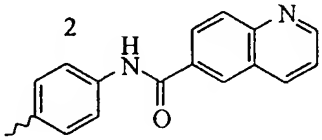
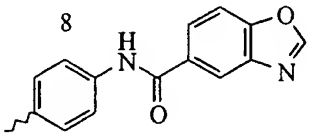
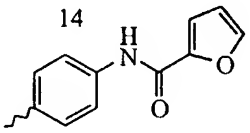
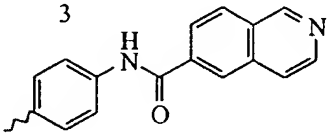
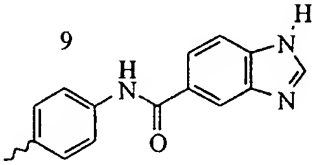
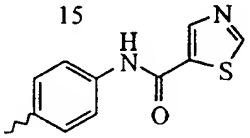
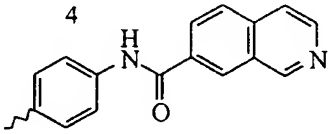
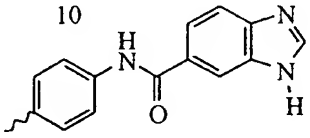
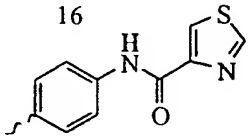
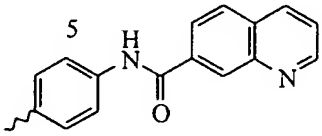
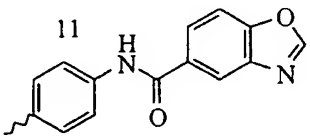
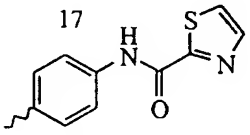
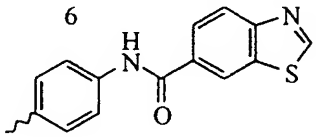
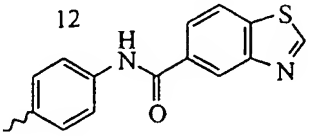
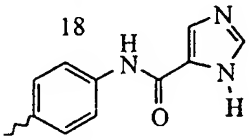


1		7		13	
2		8		14	
3		9		15	
4		10		16	
5		11		17	
6		12		18	

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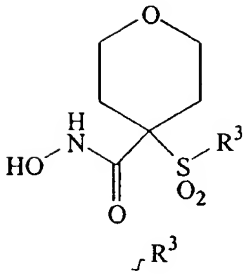


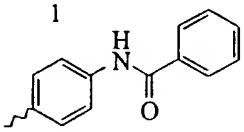
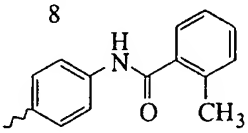
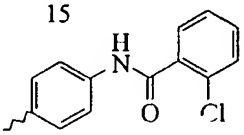
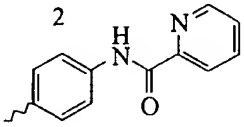
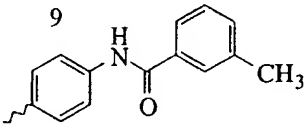
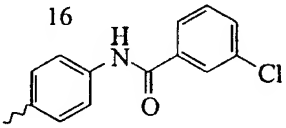
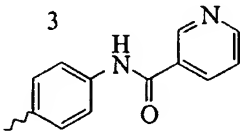
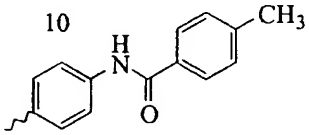
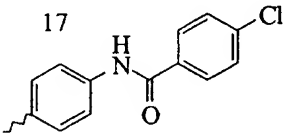
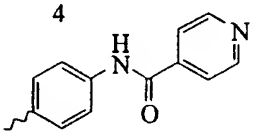
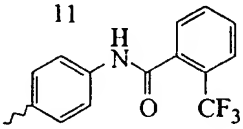
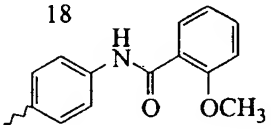
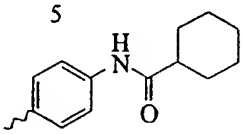
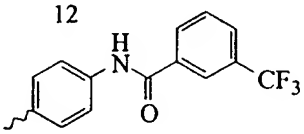
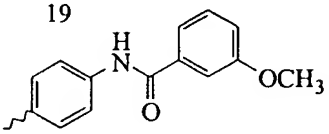
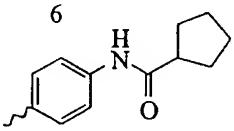
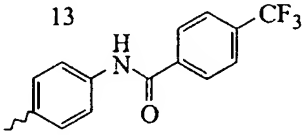
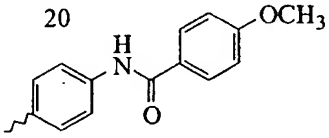
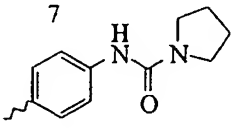
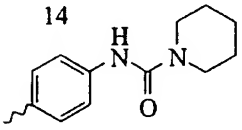
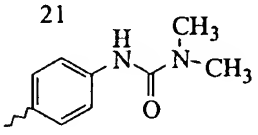
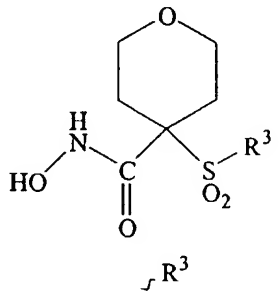
1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

Table 122



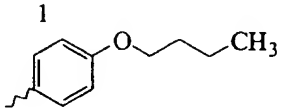
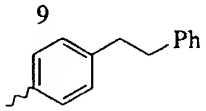
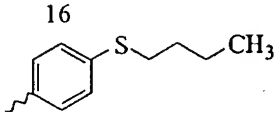
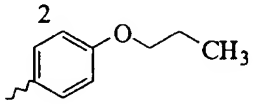
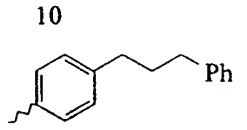
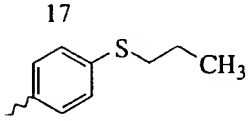
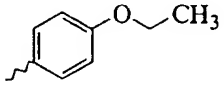
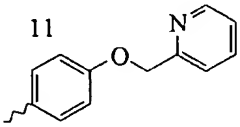
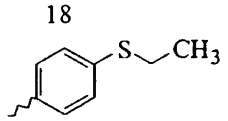
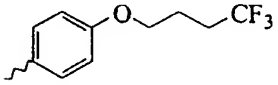
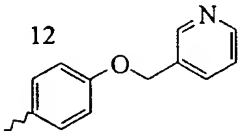
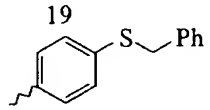
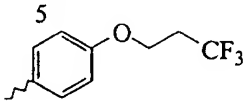
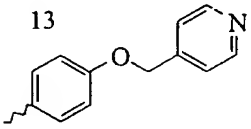
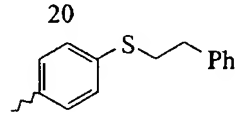
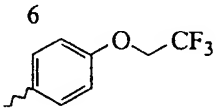
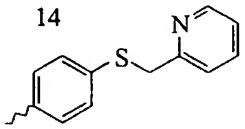
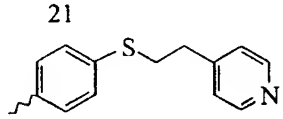
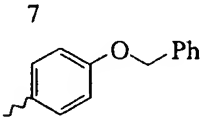
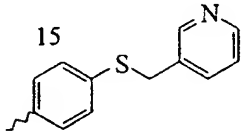
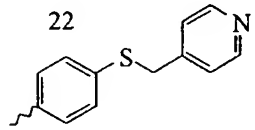
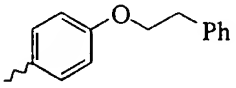
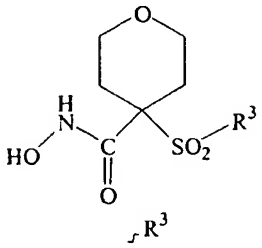
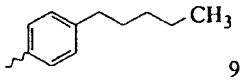
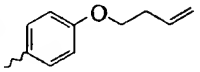
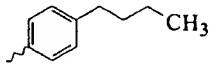
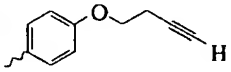
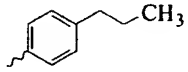
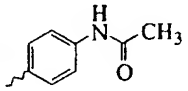
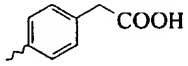
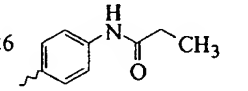
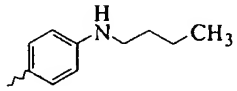
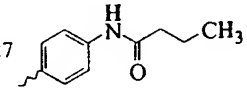
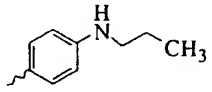
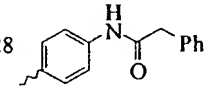
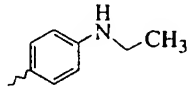
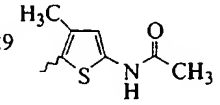
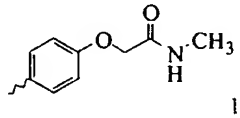
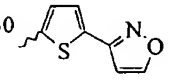
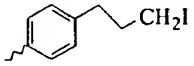
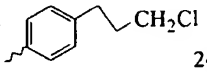
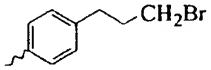
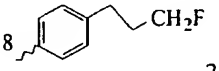
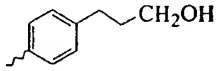
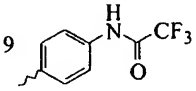
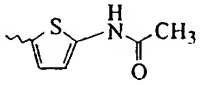
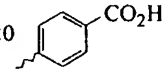
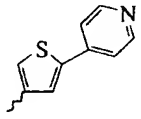
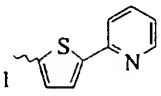
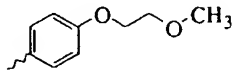
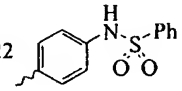
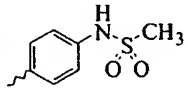
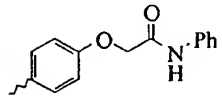
1		9 	16 
2		10 	17 
3		11 	18 
4		12 	19 
5		13 	20 
6		14 	21 
7		15 	22 
8			

Table 123



1		23	
2		24	
3		25	
4		26	
5		27	
6		28	
7		29	
8		30	
9		17	
10		18	
11		19	
12		20	
13		21	
14		22	
15			
16			

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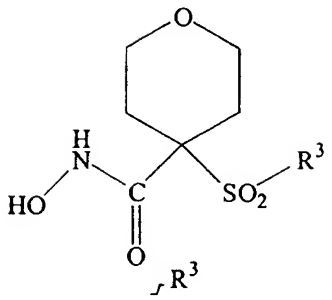
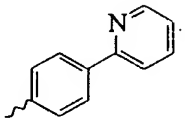
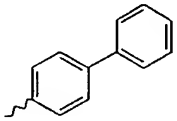
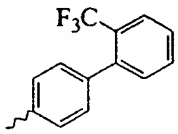
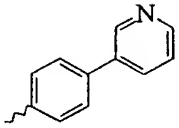
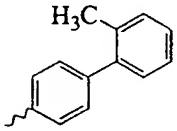
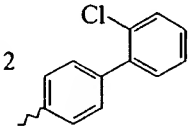
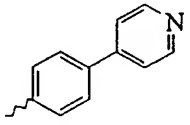
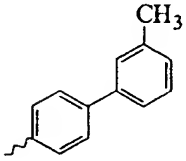
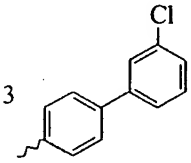
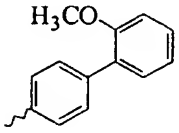
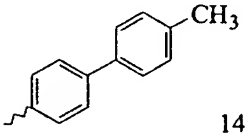
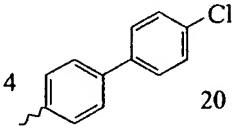
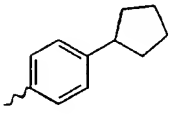
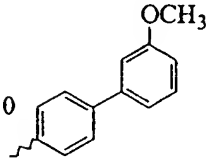
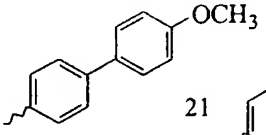
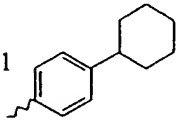
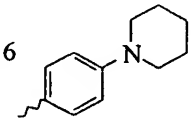


1		6 	17 
2		7 	12 
3		8 	13 
4		9 	14 
5		10 	15 
		11 	16 

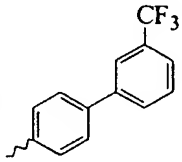
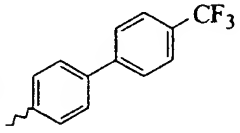
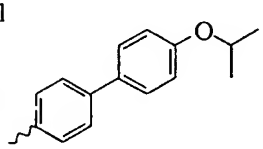
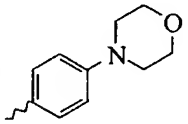
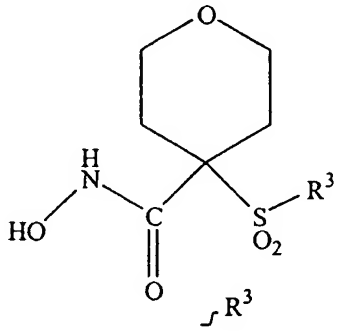
18	
19	
20	
21	

Table 125



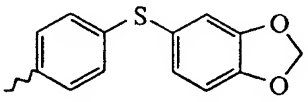
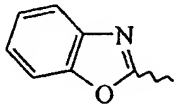
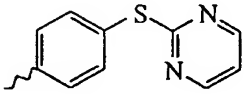
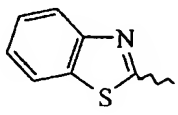
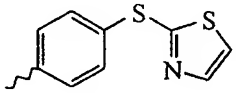
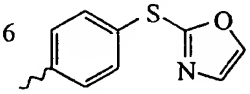
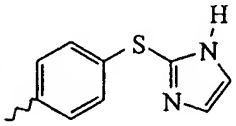
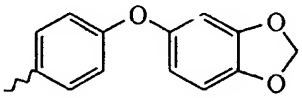
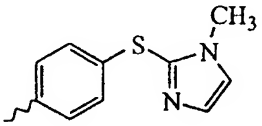
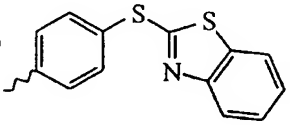
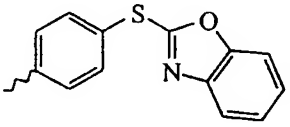
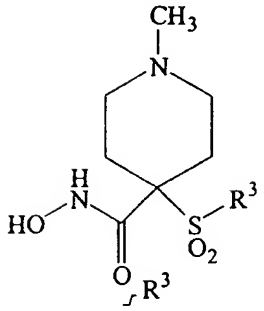
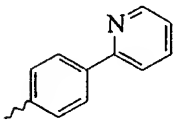
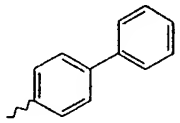
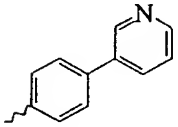
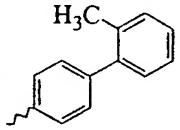
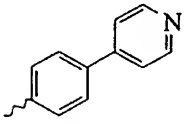
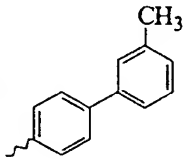
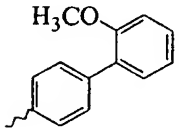
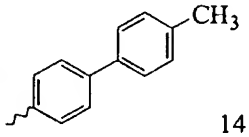
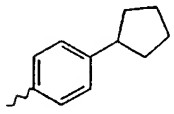
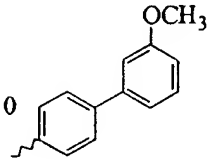
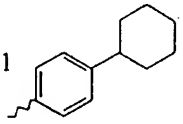
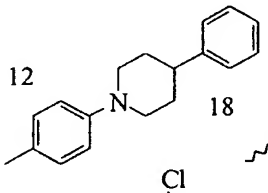
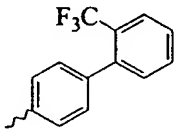
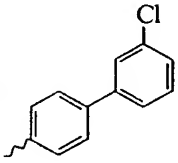
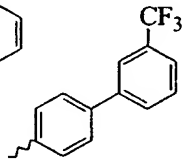
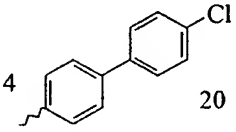
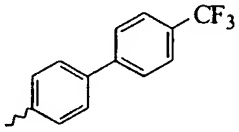
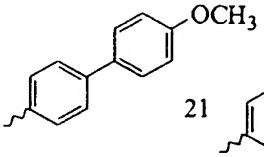
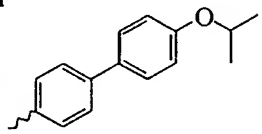
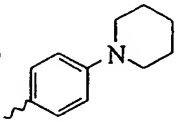
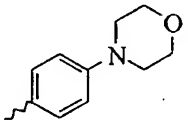
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Table 126



1		6	
2		7	
3		8	
4		9	
5		10	
		11	
12		17	
13		18	
14		19	
15		20	
16		21	

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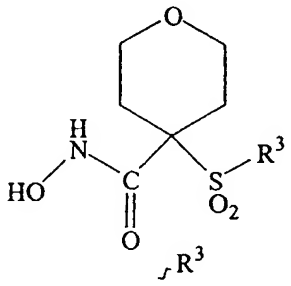
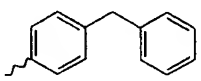
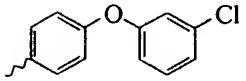
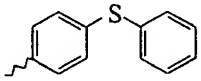
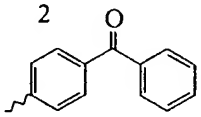
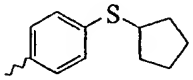
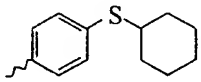
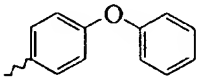
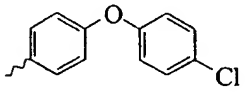
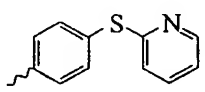
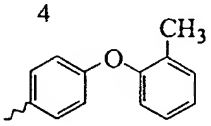
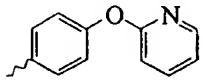
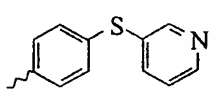
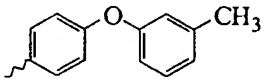
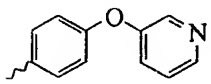
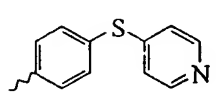
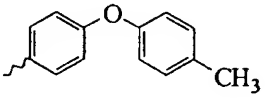
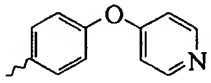
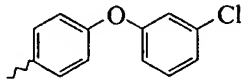
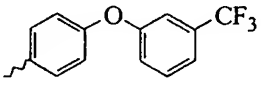
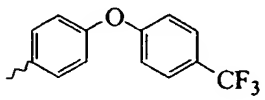
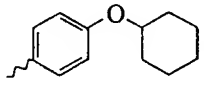


1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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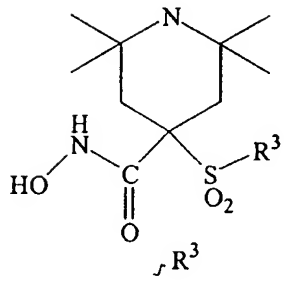
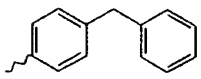
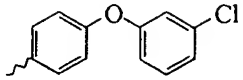
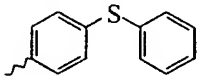
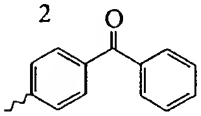
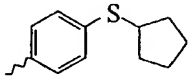
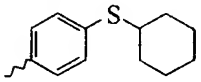
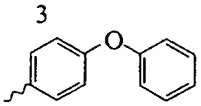
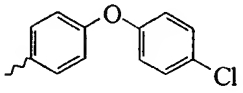
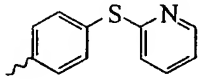
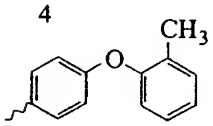
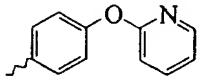
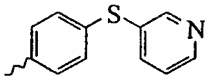
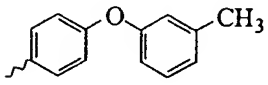
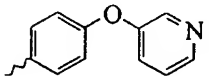
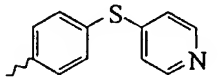
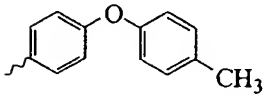
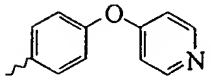
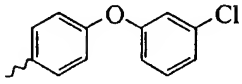
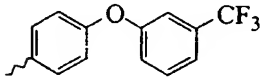
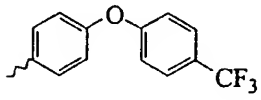
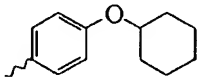


1 	8 	15 
2 	9 	16 
3 	10 	17 
4 	11 	18 
5 	12 	19 
6 	13 	20 
7 	14 	21 

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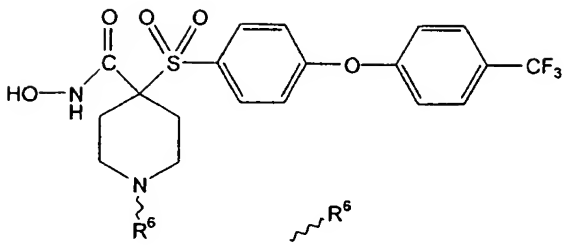
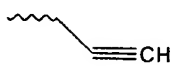
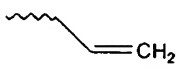
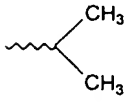
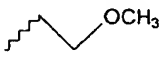
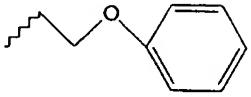
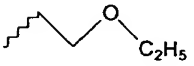
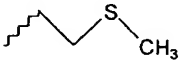
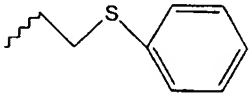
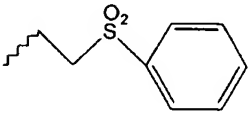
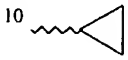
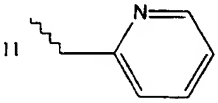
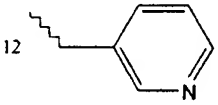
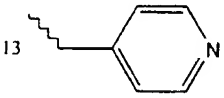
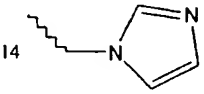
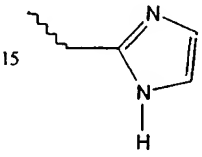
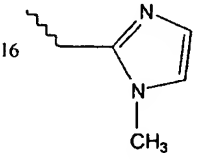
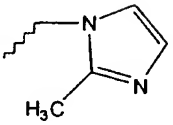
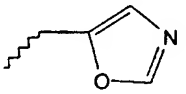
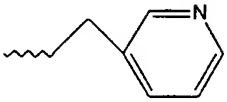


1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
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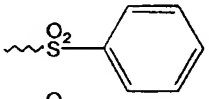
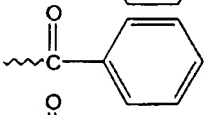
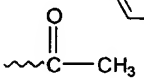
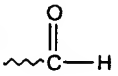
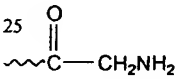
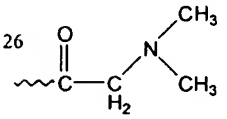
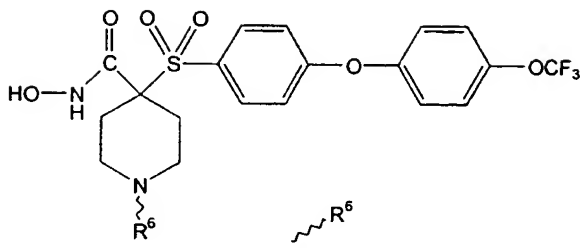
21	
22	
23	
24	
25	
26	

Table 130



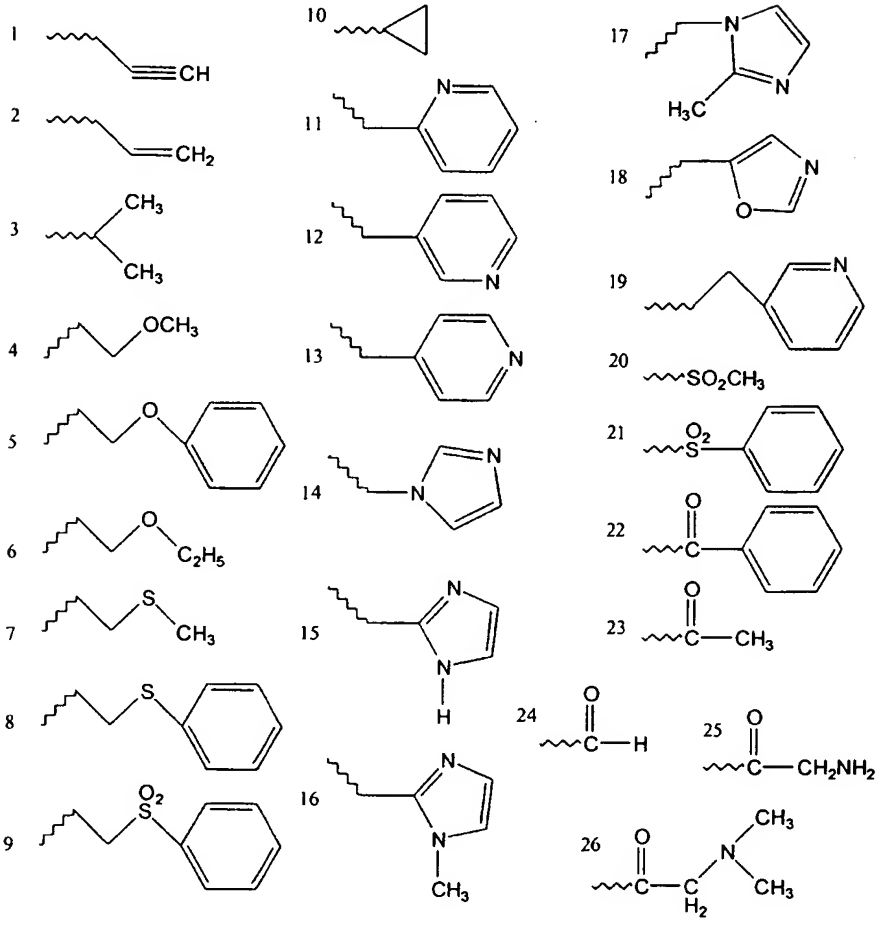
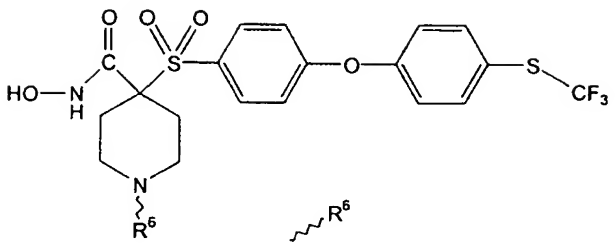


Table 131



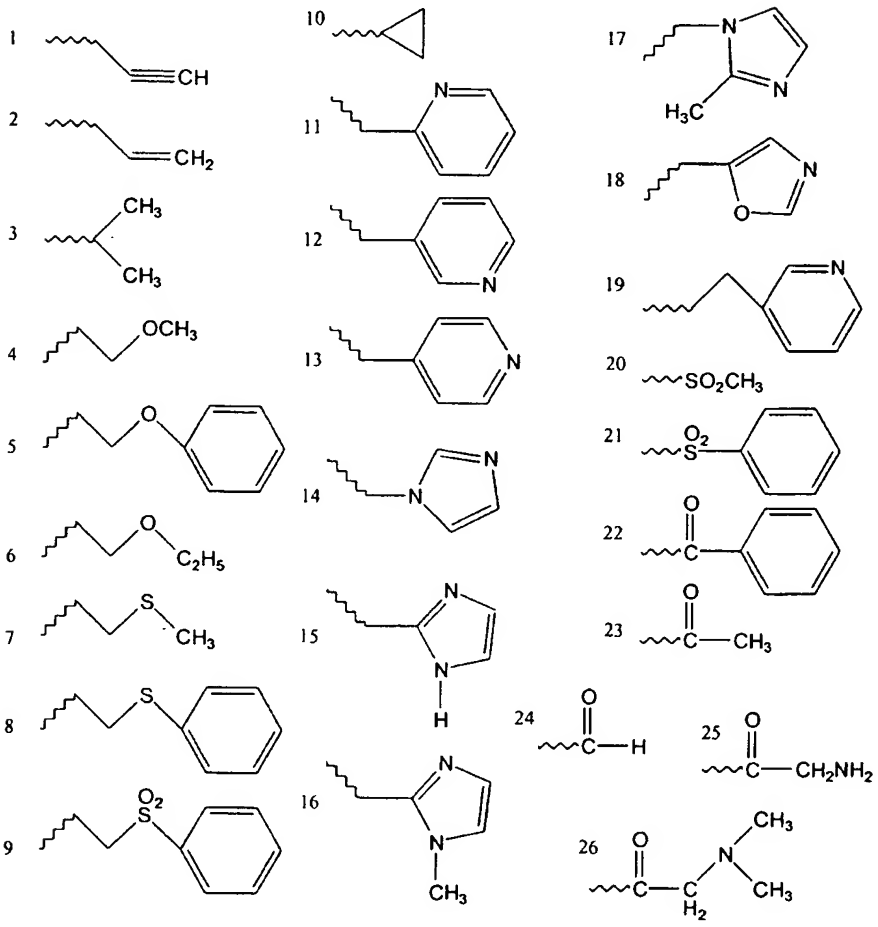
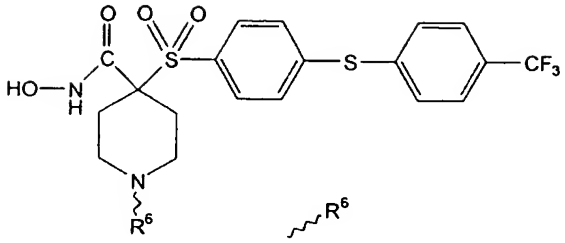


Table 132



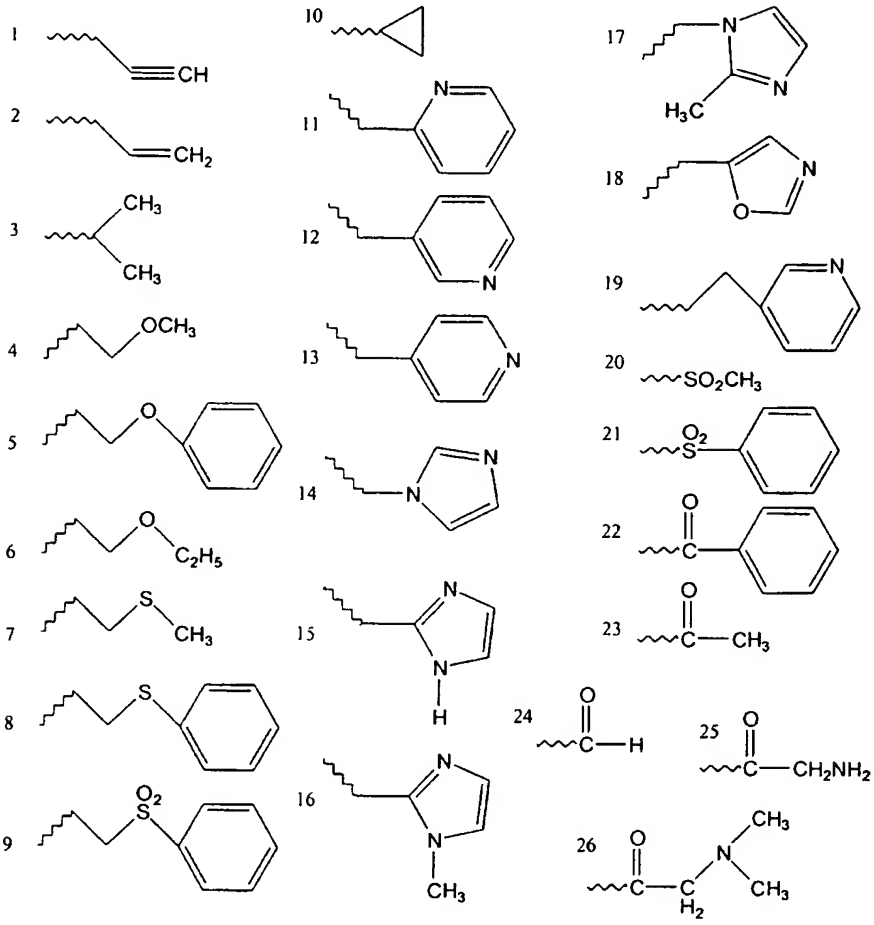
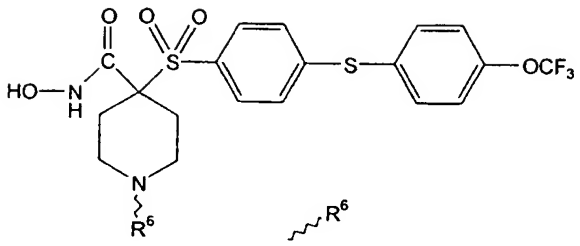


Table 133



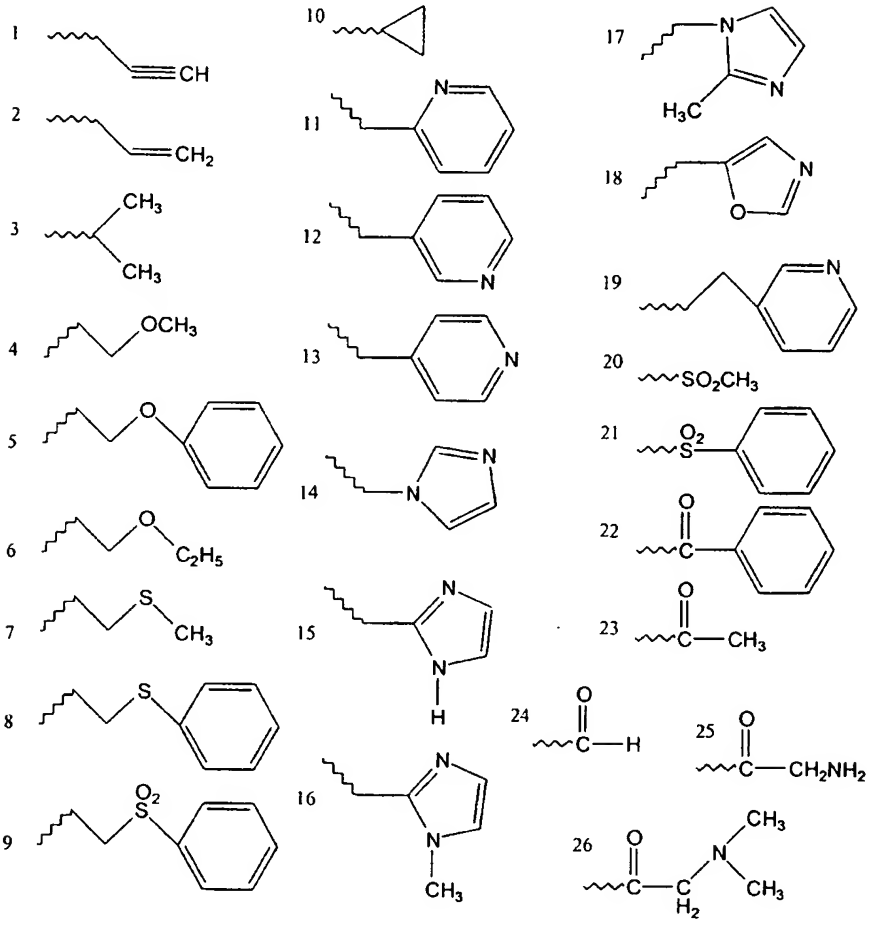
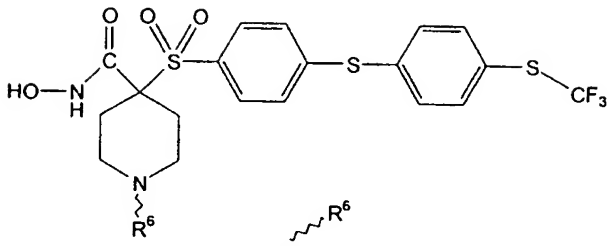


Table 134



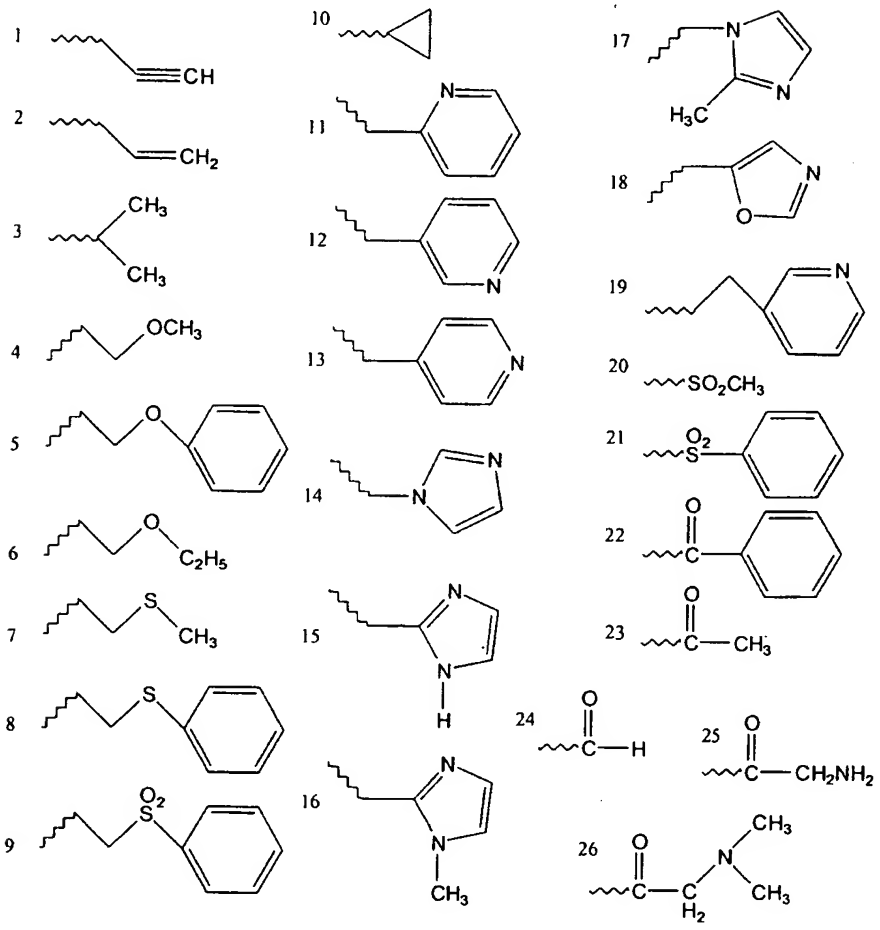
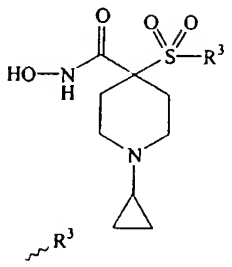


Table 135



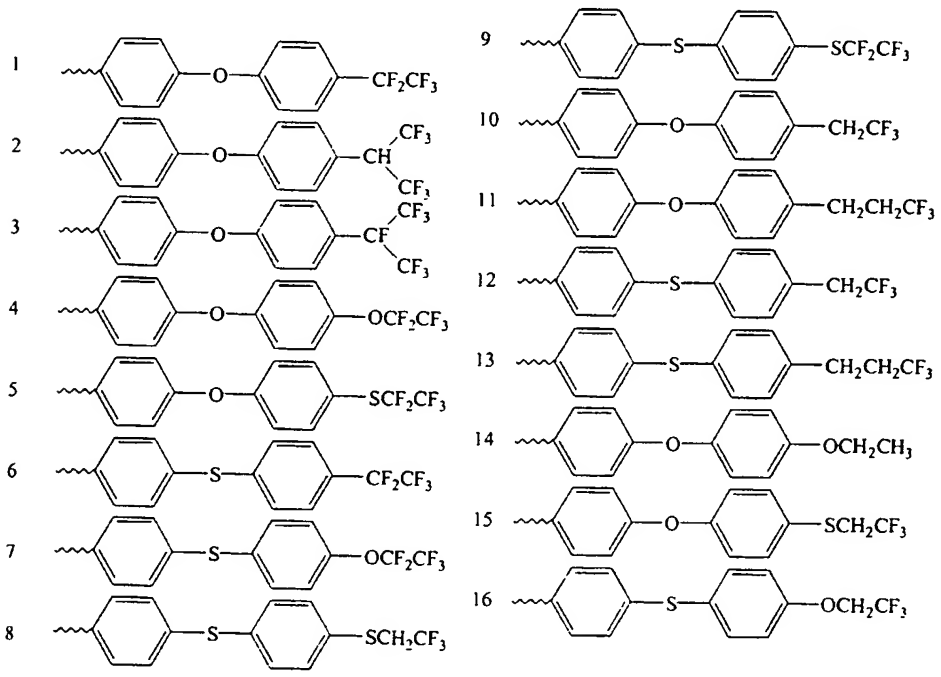
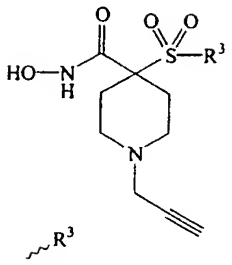


Table 136



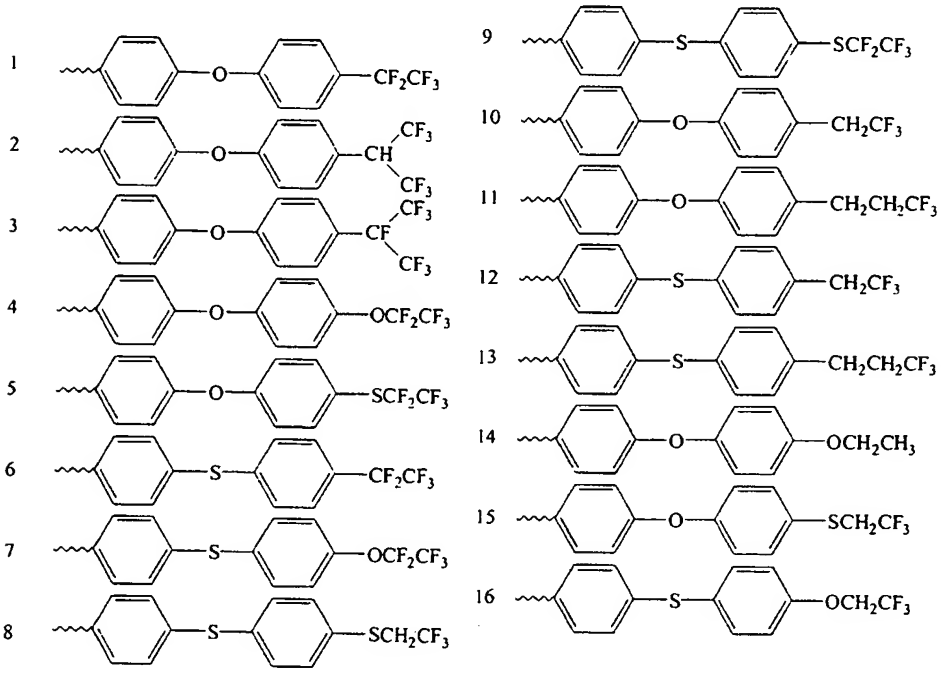
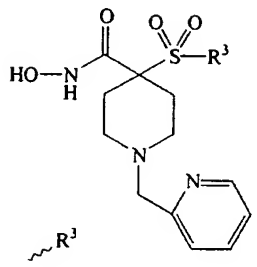

1 O CF2CF3
2 O CH CF3 CF3
3 O CF CF3 CF3
4 O OCF2CF3
5 O SCF2CF3
6 S CF2CF3
7 S OCF2CF3
8 S SCH2CF3
9 S SCF2CF3
10 O CH2CF3
11 O CH2CH2CF3
12 S CH2CF3
13 S CH2CH2CF3
14 O OCH2CH3
15 O SCH2CF3
16 S OCH2CF3

Table 137



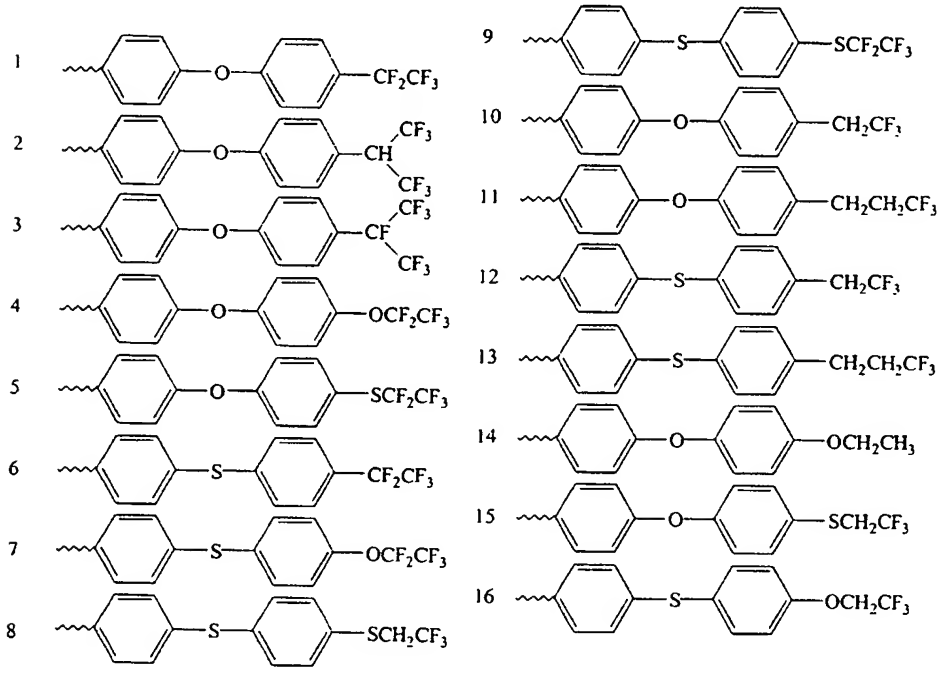
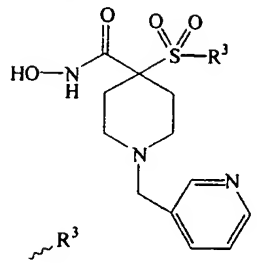


Table 138



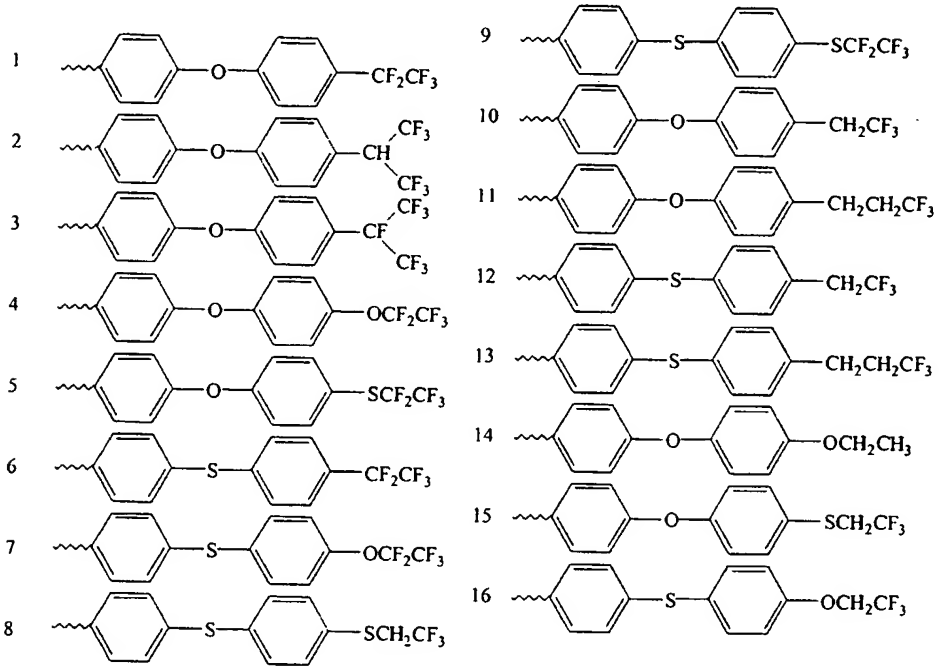
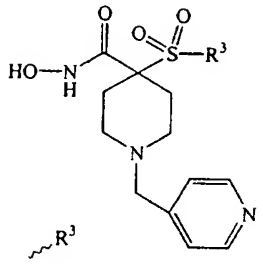


Table 139



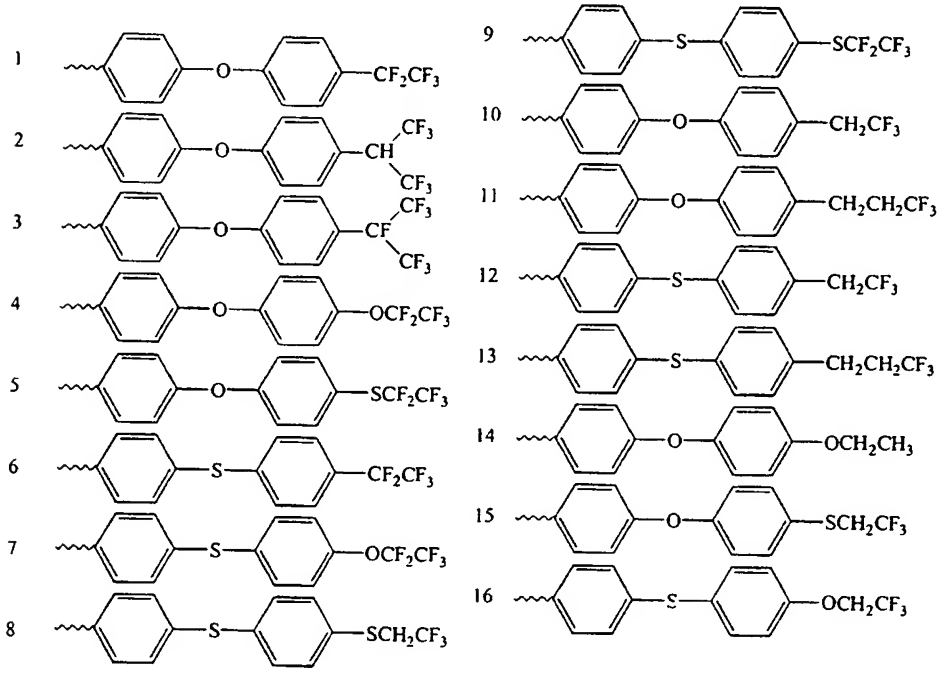
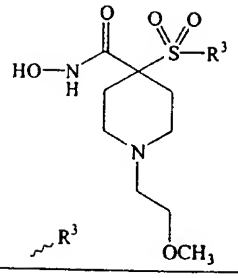

1 O CF2CF3
2 O CH CF3 CF3
3 O CF CF3 CF3
4 O OCF2CF3
5 O SCF2CF3
6 S CF2CF3
7 S OCF2CF3
8 S SCH2CF3
9 S SCF2CF3
10 O CH2CF3
11 O CH2CH2CF3
12 S CH2CF3
13 S CH2CH2CF3
14 O OCH2CH3
15 O SCH2CF3
16 S OCH2CF3

Table 140



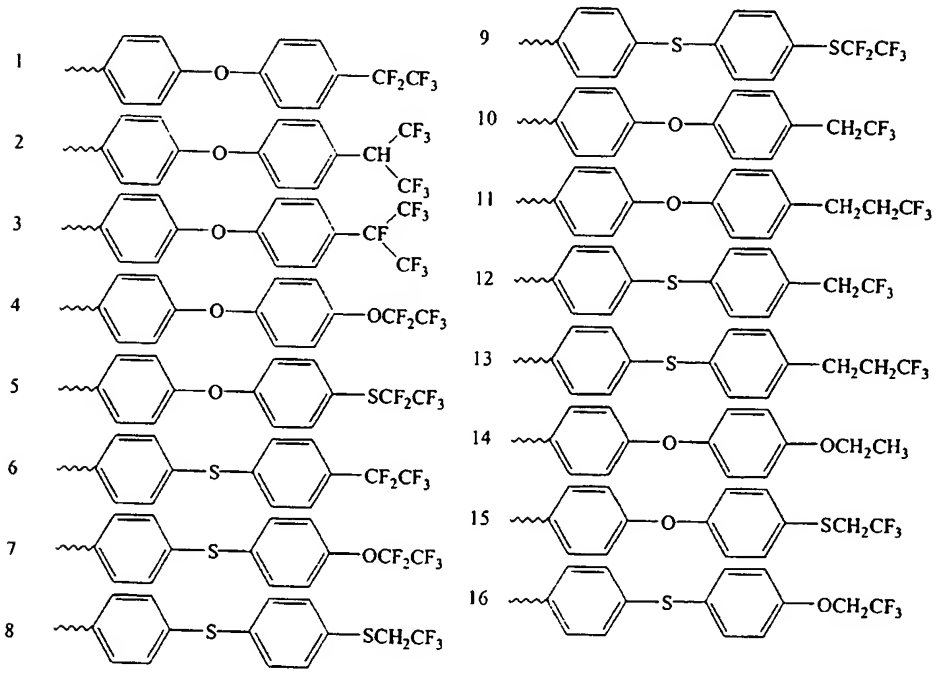
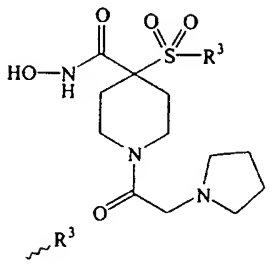

1 O CF2CF3
2 O CH CF3 CF3
3 O CF CF3 CF3
4 O OCF2CF3
5 O SCF2CF3
6 S CF2CF3
7 S OCF2CF3
8 S SCH2CF3
9 S SCF2CF3
10 O CH2CF3
11 O CH2CH2CF3
12 S CH2CF3
13 S CH2CH2CF3
14 O OCH2CH3
15 O SCH2CF3
16 S OCH2CF3

Table 141



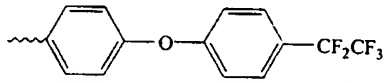
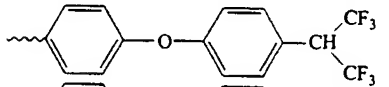
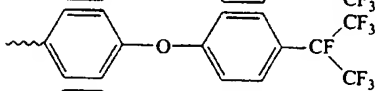
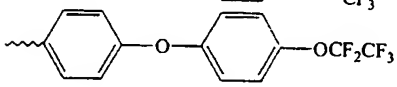
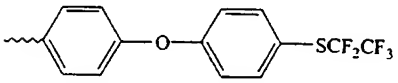
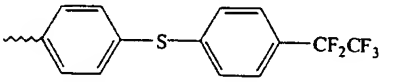
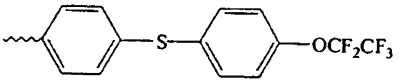
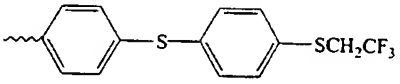
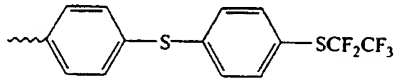
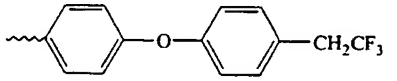
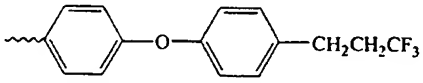
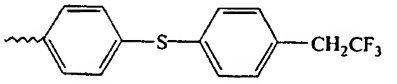
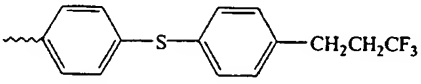
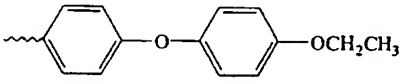
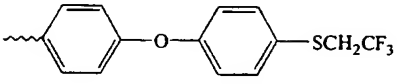
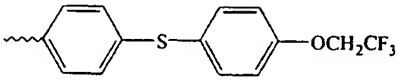
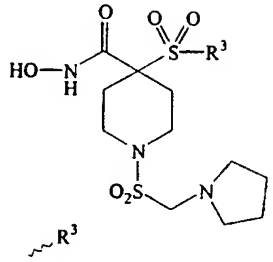
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

Table 142



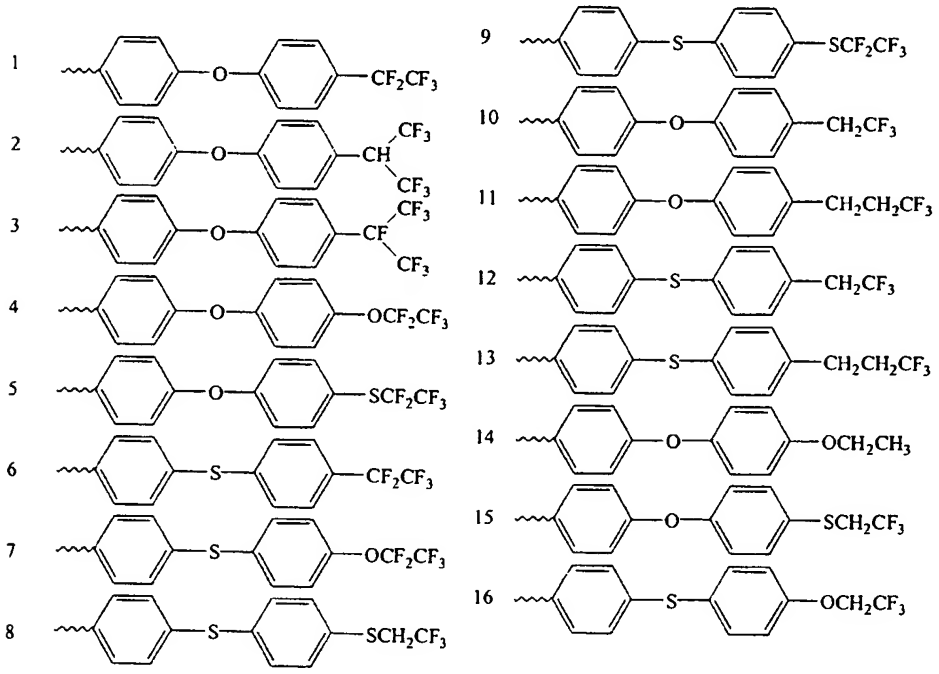
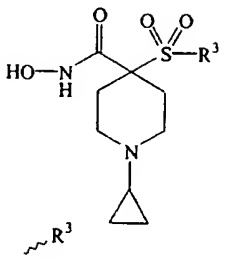

1 O CF2CF3
2 O CH CF3 CF3
3 O CF CF3 CF3
4 O OCF2CF3
5 O SCF2CF3
6 S CF2CF3
7 S OCF2CF3
8 S SCH2CF3
9 S SCF2CF3
10 O CH2CF3
11 O CH2CH2CF3
12 S CH2CF3
13 S CH2CH2CF3
14 O OCH2CH3
15 O SCH2CF3
16 S OCH2CF3

Table 143



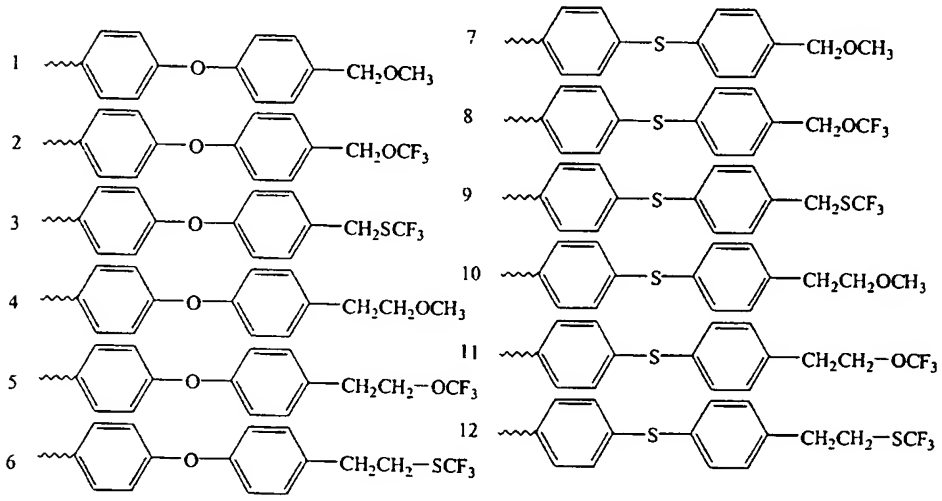
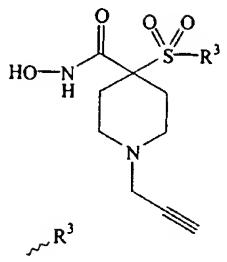

1 CH_2OCH_3
2 CH_2OCF_3
3 CH_2SCF_3
4 $CH_2CH_2OCH_3$
5 $CH_2CH_2-OCF_3$
6 $CH_2CH_2-SCF_3$
7 CH_2OCH_3
8 CH_2OCF_3
9 CH_2SCF_3
10 $CH_2CH_2OCH_3$
11 $CH_2CH_2-OCF_3$
12 $CH_2CH_2-SCF_3$

Table 144



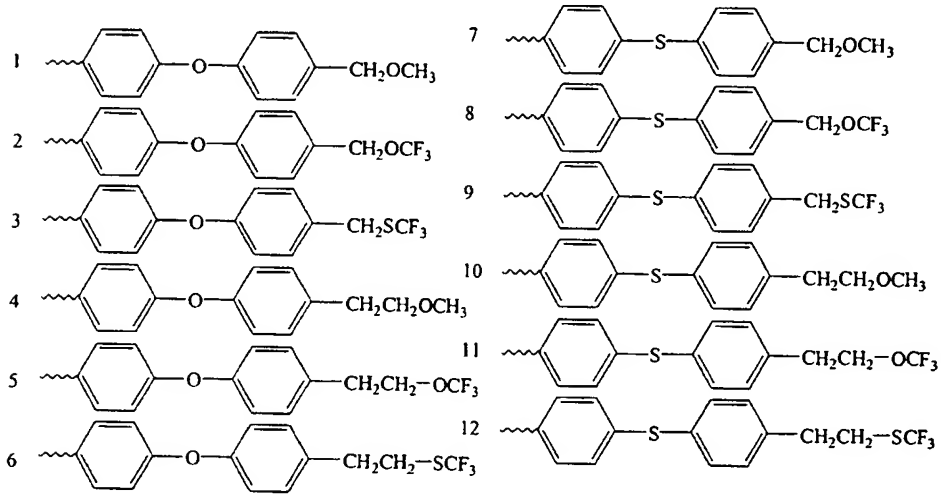
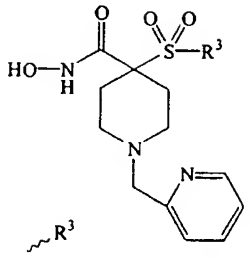

1 CH2OCH3
2 CH2OCF3
3 CH2SCF3
4 CH2CH2OCH3
5 CH2CH2–OCF3
6 CH2CH2–SCF3
7 CH2OCH3
8 CH2OCF3
9 CH2SCF3
10 CH2CH2OCH3
11 CH2CH2–OCF3
12 CH2CH2–SCF3

Table 145



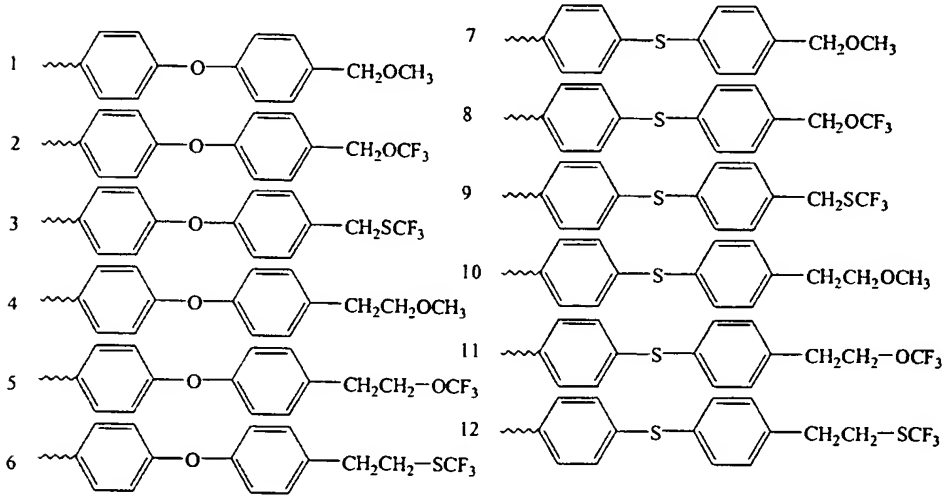
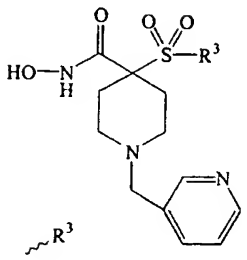

1 CH_2OCH_3
2 CH_2OCF_3
3 CH_2SCF_3
4 $CH_2CH_2OCH_3$
5 $CH_2CH_2-OCF_3$
6 $CH_2CH_2-SCF_3$
7 CH_2OCH_3
8 CH_2OCF_3
9 CH_2SCF_3
10 $CH_2CH_2OCH_3$
11 $CH_2CH_2-OCF_3$
12 $CH_2CH_2-SCF_3$

Table 146



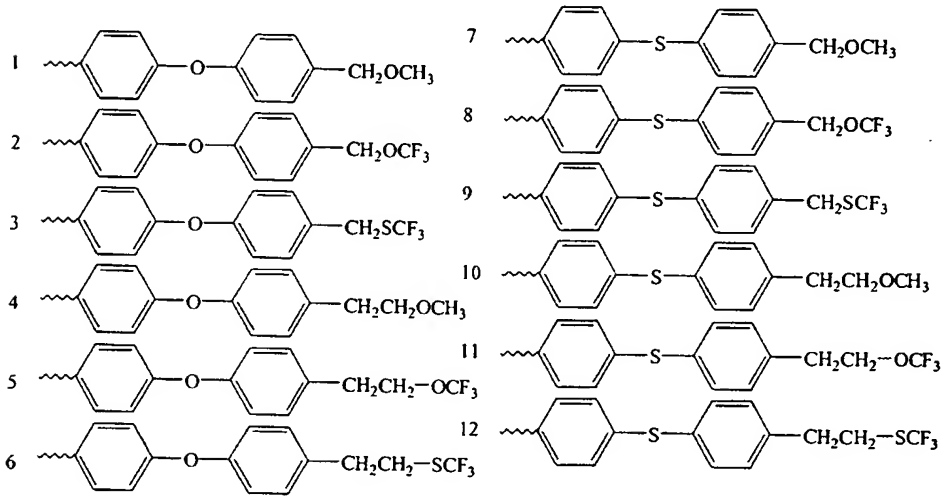
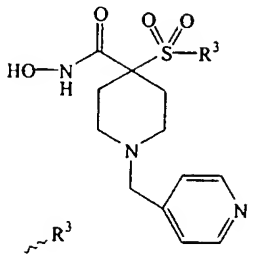

1 CH2OCH3
2 CH2OCF3
3 CH2SCF3
4 CH2CH2OCH3
5 CH2CH2-OCF3
6 CH2CH2-SCF3
7 CH2OCH3
8 CH2OCF3
9 CH2SCF3
10 CH2CH2OCH3
11 CH2CH2-OCF3
12 CH2CH2-SCF3

Table 147



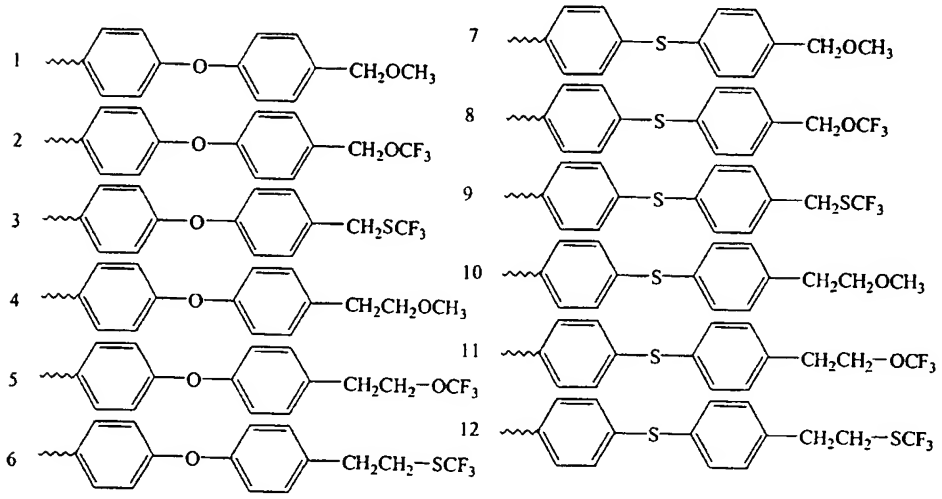
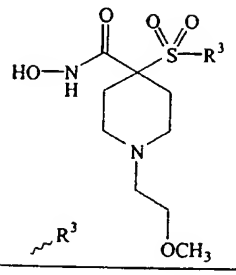

1 CH2OCH3
2 CH2OCF3
3 CH2SCF3
4 CH2CH2OCH3
5 CH2CH2–OCF3
6 CH2CH2–SCF3
7 CH2OCH3
8 CH2OCF3
9 CH2SCF3
10 CH2CH2OCH3
11 CH2CH2–OCF3
12 CH2CH2–SCF3

Table 148



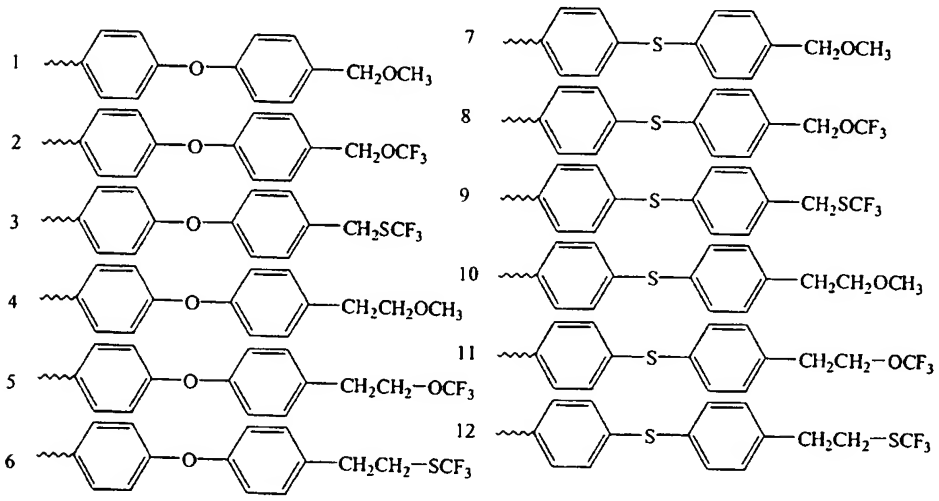
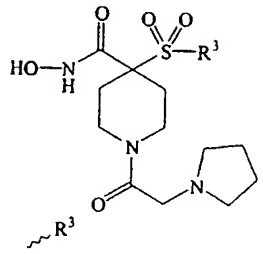

1
2
3
4
5
6
7
8
9
10
11
12
O
S
CH2OCH3
CH2OCF3
CH2SCF3
CH2CH2OCH3
CH2CH2–OCF3
CH2CH2–SCF3

Table 149



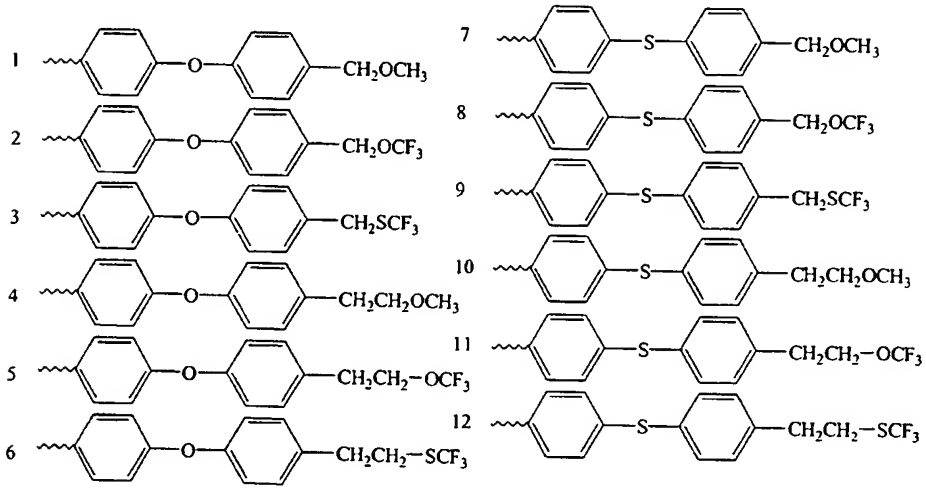
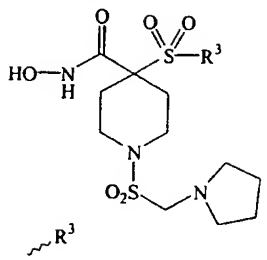
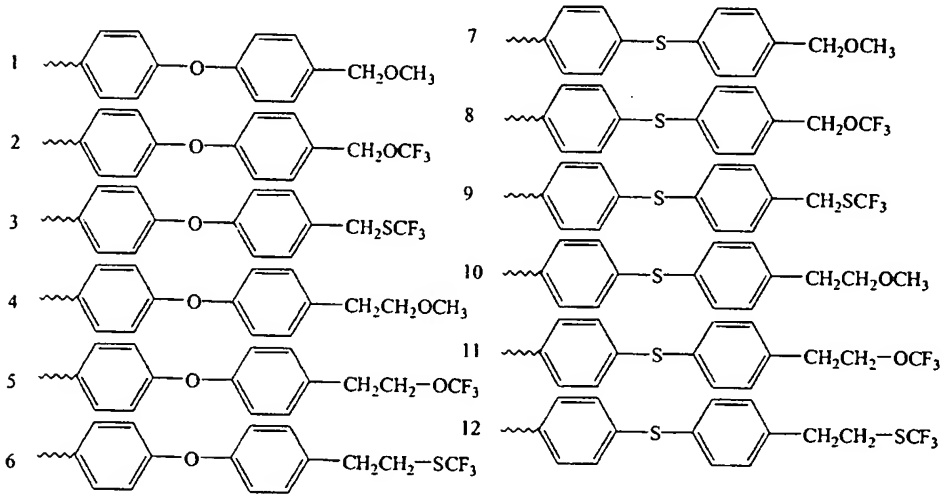

1 CH2OCH3
2 CH2OCF3
3 CH2SCF3
4 CH2CH2OCH3
5 CH2CH2–OCF3
6 CH2CH2–SCF3
7 CH2OCH3
8 CH2OCF3
9 CH2SCF3
10 CH2CH2OCH3
11 CH2CH2–OCF3
12 CH2CH2–SCF3

Table 150





A contemplated inhibitor compound is used for treating a host mammal such as a mouse, rat, rabbit, dog, horse, primate such as a monkey, chimpanzee or human that has a condition associated with pathological matrix metalloprotease activity.

Also contemplated is use of a contemplated metalloprotease inhibitor compound in the treatment of a disease state that can be affected by the activity of metalloproteases TNF-α convertase.

Exemplary of such disease states are the acute phase responses of shock and sepsis, coagulation responses, hemorrhage and cardiovascular effects, fever and inflammation, anorexia and cachexia.

In treating a disease condition associated with pathological matrix metalloproteinase activity, a contemplated MMP inhibitor compound can be used in the form of an amine salt derived from an inorganic or organic acid. Exemplary salts include but are not limited to the following: acetate, adipate, alginate, citrate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, camphorate, camphorsulfonate, digluconate, cyclopentanepropionate, dodecylsulfate, ethanesulfonate, glucoheptanoate, glycerophosphate, hemisulfate, heptanoate, hexanoate, fumarate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxy-ethanesulfonate, lactate, maleate, methanesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, palmoate, pectinate, persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, mesylate and undecanoate.

Also, a basic nitrogen-containing group can be quaternized with such agents as lower alkyl halides, such as methyl, ethyl, propyl, and butyl chloride, bromides, and iodides; dialkyl sulfates like dimethyl, diethyl, dibuytl, and diamyl sulfates, long chain halides such as decyl, lauryl, myristyl and stearyl chlorides, bromides and iodides, aralkyl halides like benzyl and phenethyl bromides, and others to provide enhanced water-solubility. Water or oil-soluble or dispersible products are thereby obtained as desired. The salts are formed by combining the basic compounds with the desired acid.

Other compounds useful in this invention that are acids can also form salts. Examples include salts with alkali metals or alkaline earth metals, such as sodium, potassium, calcium or magnesium or with organic bases or basic quaternary ammonium salts.

In some cases, the salts can also be used as an aid in the isolation, purification or resolution of the compounds of this invention.

Total daily dose administered to a host mammal in single or divided doses can be in amounts, for example, for 0.001 to 30 mg/kg body weight daily and more usually 0.01 to 10 mg. Dosage unit compositions can contain such amounts or submultiples thereof to make up the daily dose. A suitable dose can be administered, in multiple sub-doses per day. Multiple doses per day can also increase the total daily dose, should this be desired by the person prescribing the drug.

The dosage regimen for treating a disease condition with a compound and/or composition of this invention is selected in accordance with a variety of factors, including the type, age, weight, sex, diet and medical condition of the patient, the severity of the disease, the route of administration, pharmacological considerations such as the activity, efficacy, pharmacokinetic and toxicology profiles of the particular compound employed, whether a drug delivery system is utilized and whether the compound is administered as part of a drug combination. Thus, the dosage regimen actually employed can vary widely and therefore can deviate from the preferred dosage regimen set forth above.

A compound of the present invention can be formulated as a pharmaceutical composition. Such a composition can then be administered orally, parenterally, by inhalation spray, rectally, or topically in dosage unit formulations containing conventional nontoxic pharmaceutically acceptable carriers, adjuvants, and vehicles as desired. Topical administration can also involve the use of transdermal administration such as transdermal patches or iontophoresis devices. The term parenteral as used herein includes subcutaneous injections, intravenous, intramuscular, intrasternal injection, or infusion techniques. Formulation of drugs is discussed in, for example, Hoover, John E., Remington's Pharmaceutical Sciences, Mack Publishing Co., Easton, Pennsylvania; 1975 and Liberman, H.A. and Lachman, L., Eds., Pharmaceutical Dosage Forms, Marcel Decker, New York, N.Y., 1980.

Injectable preparations, for example, sterile injectable aqueous or oleaginous suspensions can be formulated according to the known art using suitable dispersing or wetting agents and suspending agents. The sterile injectable preparation can also be a sterile injectable solution or suspension in a nontoxic parenterally acceptable diluent or solvent, for example, as a solution in 1,3-butanediol. Among the acceptable vehicles and solvents that can be employed are water, Ringer's solution, and isotonic sodium chloride solution. In addition, sterile, fixed oils are conventionally employed as a solvent or suspending medium. For this purpose any bland fixed oil can be employed including synthetic mono- or diglycerides. In addition, fatty acids such as

oleic acid find use in the preparation of injectables. Dimethyl acetamide, surfactants including ionic and non-ionic detergents, polyethylene glycols can be used. Mixtures of solvents and wetting agents such as those discussed above are also useful.

Suppositories for rectal administration of the drug can be prepared by mixing the drug with a suitable nonirritating excipient such as cocoa butter, synthetic mono- di- or triglycerides, fatty acids and polyethylene glycols that are sold at ordinary temperatures but liquid at the rectal temperature and will therefore melt in the rectum and release the drug.

Solid dosage forms for oral administration can include capsules, tablets, pills, powders, and granules. In such solid dosage forms, the compounds of this invention are ordinarily combined with one or more adjuvants appropriate to the indicated route of administration. If administered per os, a contemplated aromatic sulfone hydroximate inhibitor compound can be admixed with lactose, sucrose, starch powder, cellulose esters of alkanoic acids, cellulose alkyl esters, talc, stearic acid, magnesium stearate, magnesium oxide, sodium and calcium salts of phosphoric and sulfuric acids, gelatin, acacia gum, sodium alginate, polyvinylpyrrolidone, and/or polyvinyl alcohol, and then tableted or encapsulated for convenient administration. Such capsules or tablets can contain a controlled-release formulation as can be provided in a dispersion of active compound in hydroxypropylmethyl cellulose. In the case of capsules, tablets, and pills, the dosage forms can

also comprise buffering agents such as sodium citrate, magnesium or calcium carbonate or bicarbonate. Tablets and pills can additionally be prepared with enteric coatings.

For therapeutic purposes, formulations for parenteral administration can be in the form of aqueous or non-aqueous isotonic sterile injection solutions or suspensions. These solutions and suspensions can be prepared from soerile powders or granules having one or more of the carriers or diluents mentioned for use in the formulations for oral administration. A contemplated aromatic sulfone hydroximate inhibitor compound can be dissolved in water, polyethylene glycol, propylene glycol, ethanol, corn oil, cottonseed oil, peanut oil, sesame oil, benzyl alcohol, sodium chloride, and/or various buffers. Other adjuvants and modes of administration are well and widely known in the pharmaceutical art.

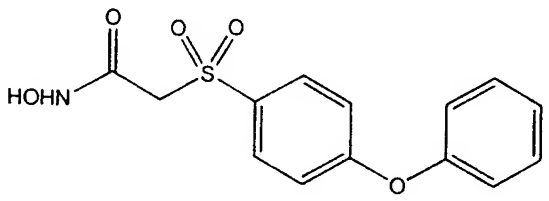
Liquid dosage forms for oral administration can include pharmaceutically acceptable emulsions, solutions, suspensions, syrups, and elixirs containing inert diluents commonly used in the art, such as water. Such compositions can also comprise adjuvants, such as wetting agents, emulsifying and suspending agents, and sweetening, flavoring, and perfuming agents.

The amount of active ingredient that can be combined with the carrier materials to produce a single dosage form varies depending upon the mammalian host treated and the particular mode of administration.

Best Mode For Carrying Out The Invention

Without further elaboration, it is believed that one skilled in the art can, using the preceding description, utilize the present invention to its fullest extent. The following preferred specific embodiments are, therefore, to be construed as merely illustrative, and not limiting of the remainder of the disclosure in any way whatsoever.

Example 1: Preparation of N-hydroxy-2-[(4-phenoxyphenyl)sulfonyl]acetamide



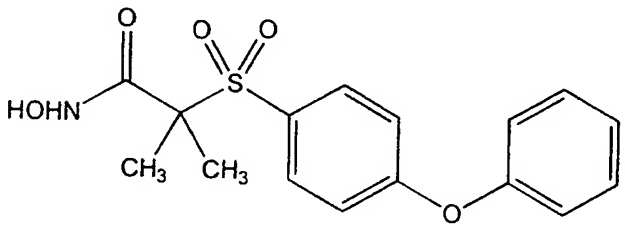
Part A: To a solution of 3-bromopyruvic acid hydrate (1.95 g, 11.7 mmol) cooled to zero degrees Celsius in methanol (50 mL) was added 4-(phenoxy)benzenethiol (2.35 g, 11.7 mmol). The solution was stirred for 15 minutes followed by concentration in vacuo. The residue was partitioned between ethyl acetate and H_2O and the organic layer was dried over magnesium sulfate. Concentration in vacuo provided the crude sulfide as a yellow solid that was used without any additional purification.

Part B: To a solution of the crude sulfide of part A (1.2 g, <2.6 mmol) in methanol/H_2O cooled to zero degrees Celsius was added Oxone® (3.5 g, 5.72 mmol). The solution was stirred for 1 hour followed by removal of excess Oxone® by filtration. The

filtrate was concentrated and the residue was dissolved into ethyl acetate and washed with saturated $NaHCO_3$ and saturated NaCl and dried over magnesium sulfate. After concentration in vacuo the resulting residue was dissolved into methanol and thionyl chloride (1.9 mL, 26 mmol) was added. Chromatography (on silica, ethyl acetate/hexane) provided the sulfone as a solid (350 mg, 44%). MS(CI) MH^+ calculated for $C_{15}H_{14}O_5S$: 307, found 307.

Part C: To a solution of the sulfone (350 mg, 1.1 mmol) in methanol (2 mL) and THF (THF; 2 mL) was added 50 percent aqueous hydroxylamine (1 mL). The solution was stirred overnight. Trituration with ethyl acetate provided the title compound as a white solid (270 mg, 77%). HPLC purity: >97%. MS(CI) MH^+ calculated for $C_{14}H_{13}NO_5S$: 308, found 308.

Example 2: Preparation of N-hydroxy-2-methyl-2-[(4-phenoxyphenyl)sulfonyl]propanamide



Part A: To a solution of 4-(phenoxy)benzenethiol (3.8 g, 18.8 mmol) in methanol (60 mL) cooled to zero degrees Celsius was added t-butyl bromoacetate (2.8 mL, 18.8 mmol) and triethylamine (2.6 mL, 19.0 mmol). The solution was

stirred for 30 minutes and was then concentrated in vacuo. The residue was partitioned between ethyl acetate and H_2O and the organic layer was washed with saturated NaCl and dried over magnesium sulfate. Concentration in vacuo provided the sulfide as an oil. To a solution of the sulfide in dichloromethane (85 mL) was added m-chloroperbenzoic acid (13.8 g, 43.2 mmol) over 15 minutes. The solution was stirred at ambient temperature for 2 hours. The reaction was quenched by the addition of aqueous Na_2SO_3. After 30 minutes the solution was filtered through Celite®. The filtrate was washed with 25 percent aqueous hydroxylamine, 1N HCl, and saturated NaCl and dried over magnesium sulfate. Chromatography (on silica, ethyl acetate/hexane) provided the sulfone as a white solid (4.0 g, 68%).

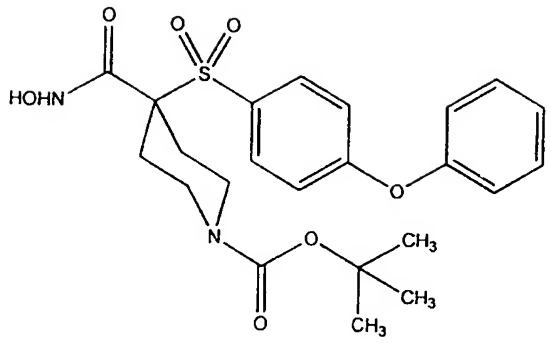
Part B: To a solution of the sulfone of part A (3.2 g, 9.2 mmol) in THF (65 mL) cooled to zero degrees Celsius was added sodium hydride (730 mg of a 60 percent dispersion in mineral oil, 18.4 mmol). After 10 minutes, methyl iodide (2.28 mL, 36.8 mmol) was added dropwise and the mixture was stirred for 18 hours at ambient temperature. The reaction was quenched with H_2O and concentrated in vacuo. The aqueous residue was diluted with ethyl acetate and the organic phase was washed with H_2O and dried over Na_2SO_4. Concentration in vacuo provided the dimethyl compound as an off-white solid (3.2 g, 92%). HPLC purity: 95%.

Part C: To a solution of the dimethyl compound of part B (3.2 g, 8.5 mmol) in anisole (10

mL) was added trifluoroacetic acid (30 mL) and the solution was stirred for 30 minutes. Concentration in vacuo followed by trituration (ethyl ether) provided the acid as a white solid (750 mg, 28%). HPLC purity: 99%. MS(CI) MH^+ calculated for $C_{16}H_{16}O_5S$: 321, found 321.

Part D: To a solution of the acid of part C (723 mg, 2.26 mmol) in DMF (DMF; 4.5 mL) was added N-hydroxybenzotriazole•H_2O (HOBT; 366 mg, 2.71 mmol) and 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (EDC; 476 mg, 2.49 mmol). After the solution was stirred for 1 hour at ambient temperature 50 percent aqueous hydroxylamine (0.40 mL, 6.8 mmol) was added. After 15 minutes the solution was partitioned between ethyl acetate and H_2O. The organic layer was washed with H_2O and saturated NaCl and dried over Na_2SO_4. Reverse phase chromatography (on silica, acetonitrile/H_2O) provided the title compound as a white foam (434 mg, 57%). HPLC purity: 99%. MS(CI) $M+Li^+$ calculated for $C_{16}H_{17}NO_5O$: 342, found 342.

Example 3: Preparation of 1,1-dimethylethyl ester 4-[(hydroxyamino)carbonyl]-4-[(phenoxyphenyl)-sulfonyl]-1-piperidinecarboxylic acid



Part A: A solution of 4-(phenoxy)benzenethiol (2.03 g, 10.0 mmol) in DMSO (DMSO; 20 mL) was heated to sixty-five degrees Celsius for 5 hours. The solution remained at ambient temperature for 18 hours. The solution was extracted with ethyl acetate and the combined organic layers were washed with H_2O and saturated NaCl and dried over magnesium sulfate. Concentration in vacuo provided the disulfide as a yellow oil (2.3 g, quantitative yield).

Part B: To a solution of ethyl isonipecotate (15.7 g, 0.1 mol) in THF (100 mL) was added a solution of di-tert-butyl dicarbonate (21.8 g, 0.1 mol) in THF (5 mL) dropwise over 20 minutes. The solution was stirred overnight at ambient temperature and concentrated in vacuo to yield a light oil. The oil was filtered through silica gel (7:3 ethyl acetate/hexanes) and concentrated in vacuo to give the BOC-piperidine compound (26.2 g, quantitative yield) as a clear, colorless oil.

Part C: To a solution of diisopropylamine (2.8 mL, 20 mmoL) in THF (30 mL), cooled to minus seventy-eight degrees Celsius, was added n-butyl lithium (12.5 mL, 20 mmol) dropwise. After 15

minutes, the BOC-piperidine compound of part B (2.6 g, 10 mmol) in THF (10 mL) was added dropwise. After 1.5 hours the solution was cooled to minus sixty degrees Celsius and the disulfide of part A (2.0 g, 10 mmol) in THF (7 mL). The solution was stirred at ambient temperature for 2 hours. The solution was diluted with H_2O and extracted with ethyl acetate. The organic layer was washed with H_2O and saturated NaCl and dried over magnesium sulfate. Chromatography (on silica, ethyl acetate/hexane) provided the sulfide as an oil (1.8 g, 40%).

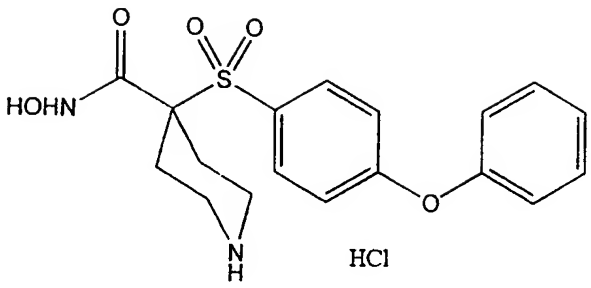
Part D: To a solution of the sulfide of part C (1.8 g, 3.95 mmol) in dichloromethane (75 mL) cooled to zero degrees Celsius, was added m-chloroperbenzoic acid (1.7 g, 7.9 mmol). The solution was stirred for 1.5 hours followed by dilution with H_2O and extraction with dichloromethane. The organic layer was washed with 10 percent Na_2SO_4, H_2O, and saturated NaCl and dried over magnesium sulfate. Chromatography (on silica, ethyl acetate/hexane) provided the sulfone as a solid (1.15 g, 59%).

Part E: To a solution of the sulfone of part D (800 mg, 1.63 mmol) in THF (9 mL) and ethanol (9 mL) was added NaOH (654 mg, 16.3 mmol) in H_2O (3 mL). The solution was heated at sixty-five degrees Celsius for 18 hours. The solution was concentrated in vacuo and the residue was dissolved in H_2O. Following acidification with 2N HCl to pH 4, the solution was extracted with ethyl acetate and the organic layer was washed with saturated NaCl and

dried over magnesium sulfate. Concentration in vacuo provided the acid as a white foam (790 mg, quantitative yield). Analytical calculated for $C_{23}H_{27}NO_7S$: C, 59.86; H, 5.90; N, 3.04; S, 6.95. Found: C, 59.49; H, 6.37; N, 2.81; S, 6.59.

Part F: To a solution of the acid of part G (730 mg, 1.58 mmol) in DMF (9 mL) was added HOBT (256 mg, 1.90 mmol) followed by EDC (424 mg, 2.21 mmol), 4-methylmorpholine (0.521 mL, 4.7 mmol) and 50 percent aqueous hydroxylamine (1.04 mL, 15.8 mmol). The solution was stirred for 20 hours and additional N-hydroxybenzotriazole•H_2O (256 mg), EDC (424 mg) and 50 percent aqueous hydroxylamine (1.04 mL) were added. After an additional 24 hours of stirring the solution was diluted with H_2O and extracted with ethyl acetate and the organic layer was washed with saturated NaCl and dried over magnesium sulfate. Reverse phase chromatography (on silica, acetonitrile/H_2O) provided the title compound as a white solid (460 mg, 61%). HPLC purity: >99%. Analytical calculated for $C_{23}H_{28}N_2O_7S$: C, 57.97; H, 5.92; N, 5.88; S, 6.73. Found: C, 57.95; H, 6.02; N, 5.81; S, 6.85.

Example 4: Preparation of N-hydroxy-4-[(4-phenoxyphenyl)sulfonyl]-4-piperidinecarboxamide, monohydrochloride



Part A: A solution of 4-(phenoxy)benzenethiol (2.03 g, 10.0 mmol) in DMSO (20 mL) was heated to sixty-five degrees Celsius for 5 hours. The solution remained at ambient temperature for 18 hours. The solution was extracted with ethyl acetate and the combined organic layers were washed with H_2O and saturated NaCl and dried over magnesium sulfate. Concentration in vacuo provided the disulfide as a yellow oil (2.3 g, quantitative yield).

Part B: To a solution of ethyl isonipecotate (15.7 g, 0.1 mol) in THF (100 mL) was added a solution of di-tert-butyl dicarbonate (21.8 g, 0.1 mol) in THF (5 mL) dropwise over 20 minutes. The solution was stirred overnight at ambient temperature and concentrated in vacuo to yield a light oil. The oil was filtered through silica gel (on silica, ethyl acetate/hexane) and concentrated in vacuo to give the BOC-piperidine compound as a clear, colorless oil (26.2 g, quantitative yield).

Part C: To a solution of diisopropylamine (2.8 mL, 20 mmoL) in THF (30 mL), cooled to minus seventy-eight degrees Celsius, was added n-butyl lithium (12.5 mL, 20 mmol) dropwise. After 15